Chapter 4
System Analysis & Design of Uniform Mechanized Office Administration System of Colleges
– a Case Study of Select Under-graduate Colleges in West Bengal *

4.0 Review of the Existing System

The following research questions guided the investigation:

- What information technologies and services comprise networked information, and to what degree are these similar across various academic institutions?
- Who are the "users" of networked information within the academic setting?
- What are the organizational structures used in academic institutions to provide networked information services?

An exploratory and qualitative approach was followed that include techniques such as focus groups interviews, site visits, and the analysis of academic computing strategic plans. The researcher identified non-teaching staff, bursars and the principals of the degree colleges, systems administrative officer of open-university and senior technical officers and assistants of university departments as focus groups for interview, in order to draw the work-flows of the different functions of different departments. The sessions typically lasted for one to two hours each time, where the focus was to

* This case study was conducted through UGC sponsored Minor Research Project by the researcher as the background study to develop a logical Management Information System for University-Colleges Cluster as required in the present research. Eight institutions in West Bengal including University Departments and the Eastern Regional Office of IGNOU were visited, to study the workflow of the different administrative functions and relations, and the observations were collectively used to make the System Analysis & Design. It is observed in the case study that all the Degree Colleges follow the same administrative rules and procedures, and their areas of operation were also the same. Hence the findings and observations are presented in a consolidated form.
understand: (1) the nature of their experiences regarding related network activity, (2) the amount of time spent on that particular activity, and (3) the user's assessment of the usefulness or success of that particular activity. The questions posed in the interviews range from unstructured to structured ones (as done in the later stages). The site visits were done to obtain first-hand information of specific facilities and services, and to obtain reports, brochures, and examples of services available. In these exercises, the main focus was to draw flow-charts of different regular natured functions that are considered to find place in the transaction processing system and in the construction of M.I.S.

The findings from the study are presented in a consolidated form in *systems analysis* as presented in sections 4.1 to 4.4 (*with reference to the Survey Findings- Institution-wise as presented in Annexure 9*), which include functional entities relationship study, review of organizational set-ups, feasibility study of mechanization, requirement analysis and the requirement specifications. Key observations that emerged from the systems analysis, include:

- An adequate network infrastructure is believed to be essential to attract and retain high quality faculty and students. Elements of the academic networked environment which may be consistent across institutions include: electronic mail, campus-wide information systems; the constituent groups including administrators, staff, faculty, students, and the community; and a technological support structure.

- Existing technologies and information services are lagging behind user demand in rural and semi-rural based colleges.

- There are numerous barriers, including political factors, which limit the degree to which academic institutions engage in regular networking operations.
Most of the degree colleges except a few have yet to formalize some type of MIS for their network and thus are unable to comprehensively capture, organize, analyze, and report information on a timely basis or simplify and standardize network data gathering and reporting procedures across the institution. This results in repetition of office works to generate MIS in various formats at various occasions.

Other issues and findings from the review are detailed in section 3.4.1, where the scenario of some of the institutions having advanced IT-enabled systems are highlighted; and also presented in section 6.1, where overall observations are made. While reviewing the existing systems of some of the selected institutions in West Bengal based on survey questionnaires (in Annexure 8) and the detailed survey findings (in Annexure 9), some of the relevant observations as made while reviewing the campus network scenario are detailed below.

A) Technical Infrastructure (the hardware, software, equipment, communication lines) – basic infrastructure available in all the institutions (8 visited) through UGC supports (capacity building schemes); in all the institutions visited, local area networks (LANs) are connected to each other, and to off-campus networks through routers (IIT, CU). In some cases (IIT, IGNOU) the routers are centralized in a common location with direct fiber or coaxial connections to the various sub-networks scattered about the university environment. From this router "pool," connections are made to computers acting as servers and to the Internet. In other cases (CU, St. Xaviers), the routers are not centralized but interconnected in some manner that consolidates access to common servers and to the Internet. Data collection takes place at each router location; campus community access to internet and other programs on shared servers provided.
B) Distributed Network and Computing Environment (some type of central computing and network unit with responsibilities for the entire campus) - the degree to which the academic campus has distributed networking and computing services vary from campus to campus. But the current trend appears to be the development of a more distributed networking and computing environment. IIT, ISI, and IGNOU have their own Systems Managers to look after their distributed network, while Rajabazar Science College (CU) hire private network consultants on AMC. Under-graduate degree colleges visited have not yet developed full-fledge distributed network, though wired some of their departments by LAN and have broadband/ wi-fi connectivity; Cluster developments in affiliated colleges visited - nil.

C) Content (the information resources available on the network) – partially available in degree colleges through UGC supported Network Resource Centers (e-educational network, INFLIBNET); IIT, St. Xavier’s and IGNOU have developed their own multimedia contents development centers as well as sharing mechanisms; Campus-wide information service (CWIS), a web-based application that integrates and makes available a range of information services on a campus through a common user interface and provides faculty, staff, and students easy access to information that resides on computers both on campus and beyond, and networked classrooms - available at IIT.

D) Services & Support (the activities in which users engage and the services that users may use to complete various tasks) – services identified under broad heads: Staff Management, Payroll, Students’ Administration, Library Management, Finance & Accounts, as presented in section 4.1.1 to 4.1.3, applicable for all institutions; routine-natured functions under network mechanized in all institutions visited;
cluster-colleges’ on-line admission system installed in some Kolkata based colleges under C.U.; ERP installed in ISI, IIT; ELMS installed in IGNOU, IIT; CPSMS installed partially in ISI, IIT; Govt./aided affiliated colleges (3 visited) have yet to formalize some type of MIS and thus are unable to comprehensively capture, organize, analyze, and report information through a organized mechanization process, and are unable to determine which specific types of data are most important for collection and analysis, resulting in uncoordinated reporting and MIS generation with repletion in data consolidation works.

E) Overall Management – review of the under-mentioned aspects based on site visits (refer Annexure 9).

<table>
<thead>
<tr>
<th>Nature of queries in systems analysis</th>
<th>Aided colleges (3)</th>
<th>Autonomous college (1)</th>
<th>University (1)</th>
<th>Open University (1)</th>
<th>Tech Institute (1)</th>
<th>Research Institute (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respond to enquiries–received online</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Facilitate communication through email</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Supporting and maintaining website</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Enroll students on-line</td>
<td>No</td>
<td>Partial</td>
<td>Partial</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Collect fees-computerized</td>
<td>Partial</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Manage courses-on-line</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Partial</td>
<td>No</td>
</tr>
<tr>
<td>Existence of ELMS &amp; ICT Tools</td>
<td>No</td>
<td>Partial</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Record student exam entries and results-computerized</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Library automation</td>
<td>Partial</td>
<td>Partial</td>
<td>Partial</td>
<td>NA</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Computer literacy of staff</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Links between central MIS and finance systems</td>
<td>No</td>
<td>Partial</td>
<td>Partial</td>
<td>Partial</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Computerized payroll</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>OMR Attendance Registers</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>LAN connected campus</td>
<td>Partial</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Generate performance data online</td>
<td>No</td>
<td>Partial</td>
<td>Partial</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Just-in-Time Management reporting through RDBMS</td>
<td>No</td>
<td>Partial</td>
<td>Partial</td>
<td>Partial</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Ensuring security of ICT systems</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
4.1 Functional Entities Relationship Study

The following essential functional entity relationships are identified through the case study that are considered relevant to be considered while designing a transaction processing and management information system of a College / Institute :-

- Institute-Student (including academic and library service)
- Institute-Staff
- Institute-External Bodies (eg. UGC, DPI, University, other affiliating bodies, ministry department, industries, etc.)
- Institute-Bank & other financial institutions
- Institute-Outsourcing service providers.

The output requirement analysis of these entities constitutes the transaction processing and management information system. Of these categories, the first two require special study as their interactions with the institution is of recurring nature.

4.1.1. Institute-Student Entities

An institute or college employ many teachers and non-teaching staff, and can admit many students. So the relationship between college or institute with students and staffs is one to many. The college or institute has a specific fee structure, which the students are to pay. This pay depends on the student’s class and course. The institute or college follows the course structure designed by the controlling organization, generally the University, and follow the specific Admission Norms for granting admission to the students. Following the admission procedure, the students get admitted to a particular class. The institute then takes initiative to deliver Registration Certificate to the students after complying with the migration formalities (if any). For evaluating the progress of the students, the institute or the college conduct examinations and generate results. The students, based on their educational quality get
their result by way of Progress Report or the like. Moreover, students may opt for transport facility (if available) and the hostel facility against additional fees. After each term-end, the institute or college arrange to send the names of the test qualified students to appear for the main University Examination through examination form fill-up formalities. Finally the institute or college takes the initiative to collect the Mark-sheets and Certificates of the qualified students from the office of the University and deliver the same to the individual students.

In addition, the institute or college also need to take initiatives to organize, manage and control the student’s participation in Students’ Welfare Schemes, viz., NCC, Students’ Health Home, Social Service Projects, Career Counseling, Students’ Union, and the like. It also need to look after some annual events like Students’ Union Election, Annual Sports, Annual Function/ Exhibition/ Fair, Sport Tournament Events, and Excursion trips.

Moreover, an institute or college also need to maintain well organized Library & Information Centre, First-Aid Centre, Computer Lab, other Laboratory Centres, and also Audio-Visual Lecture Halls.

Therefore, the main activities related with students that a college or institute has to perform or has to maintain as a routine work include:

1. Determining the Fee Structure (Class and Subject-wise)
2. Course Structure and Academic Planning (Routine setting and maintenance of Duty Roster of Teaching Staff)
3. Determining Admission Norms
4. Calculation of Admission Fee amount and issue of Admission Slip to students
5. Preparing the database of newly admitted students
6. Formalities for granting change of stream / subject(s) to students
7. Checklist of Registration Certificates and Identity Cards of Students
8. Generation of Stream-wise students’ details
9. Generation of Class-wise students’ details
10. Generation of Subject-wise students’ details
11. Maintenance of Students’ Attendance Registers (Class + Subject-wise) and calculation of their aggregate attendance percentage
12. Complying with the fee collection procedures (One-time Fees, and subsequent periodic fees under different heads)
13. Maintenance of Fee Register and calculation of Dues
14. Granting of Fee Concession based on socio-economic criteria
15. Administering the Scholarship Schemes of SC/ST/Minority students
16. Preparation of time-table of Annual Examination, Half-Yearly Examination, Qualifying Test Examination and other Tests
17. Arrangement for conducting Re-Examination
18. Compilation of Results – detailed and consolidated student-wise
20. Library & Information Center Management, mainly comprising of:
   - Cataloguing of books & journals
   - Maintenance of Book Stock Register,
   - Updating of Members’ Register
   - Generation of Requisition Book List and Purchase Order
21. Laboratory Management, comprising of stock maintenance, student attendance, class scheduling, and ‘activity book’ maintenance, and

22. Maintenance of separate files of extra-curricular activities like NCC, Students’ Health Home, Social Service Projects, Career Counseling, Students’ Union, Students’ Union Election, Annual Sports, Annual Function/Exhibition/Fair, Sport Tournament Events, and Excursion trips.

Presented below is a sample Entity Relationship Diagram in Fig. 4.1 to describe the relationship between an institution/college and the different entities with which it has relationship.
The ER Diagram as displayed above represents the general scenario of all the institutes surveyed where ‘student-teacher-institute’ relationship exists. However the research institute like ISI has another entity, namely the ‘researcher’, who are not covered in the ER Diagram, as their work are not of repetitive nature and cannot be automated. Open university like IGNOU and tech-university like IIT having multi-location centers maintain central monitoring or control unit at their headquarter to look after the inter-institutional communication works. Such ‘central monitoring unit’ can also be considered as ‘entity’, but not included in the ER Diagram as the research objective is to design a model for affiliating colleges and not for open universities or tech-institutes.

4.1.2 Institute-Staff Entities

In an institute, staffs normally consist of Teaching Staff, Part-time Teaching staff, Non-Teaching Staff and Casual Staff. They are headed by Principal & Secretary. The apex body normally consist of a Board of Governing body members, sometimes referred to as The Council, headed by one President /Chairman. The other members of the Governing Body comprise of representatives of the University/Apex Institute, local municipality, teaching and non-teaching staff, students and guardians. The election of the governing body takes place at certain intervals. The Governing Body is the principal decision-making body and takes all relevant decisions regarding the state of affairs of the institute through Resolutions in the G.B. Meeting. For the purpose, the college/institute organize G.B. Meeting, the proceedings of which are recorded in Minute Books and the decisions in the Resolution Book. It is generally found that part-time teaching staff and casual staff get consolidated pay packet from the internal College Fund. For record, separate files are maintained for each of them.

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The regular teaching and non-teaching staffs perform their assigned routine duties to achieve the overall objectives of the organization. In addition, the institutes/colleges also have to look after the staff’s interests through the execution of the following recurring natured activities:

1. Compliance of staff joining formalities
2. Maintaining staff attendance and leave details
3. Maintaining the Acquittance Roll and Salary payments formalities (including generation of Pay Slip)
4. P.F. deductions and its accounting
5. Retirement Papers processing
6. Tax Calculations (F-16) & TDS
7. Service Book maintenance, and
8. Preparing and maintaining Promotion papers and increment details.

### 4.1.3 Other Important Activities of Institutes / Colleges

In addition to the aforementioned activities, the institutes/colleges also need to perform some routine housekeeping activities, which include:

1. Inventory Management
2. Finance & Accounts works (including compliance of Audit procedures)
3. Public Relation works
4. Secretarial activities, including activities related to Governing Body.

Regarding Public Relations activity, it is observed that the institutes/colleges generally maintain regular contact with the different departments of the University /Apex Institute, DPI Offices and with the UGC. They need to provide, from time to time, management information and utilization reports in prescribed formats. The other bodies with whom the institutes/colleges also keep contact include College
Service Commission, Auditor Generals’ office, Association of Indian Universities (New Delhi), Tourism Department, Ministry of Education (GOI), DPI(General Affairs), Sports Board, Training Centre for SC & ST, National Information Centre, and NCC’s Regional Headquarter.

The institutes/colleges also perform some non-routine activities, which include organizing Seminars / Conferences / Workshops and participating in Research & Development activities.

4.1.4 Departmentalization of Activities for Better Management

Departmentalization is the grouping of the activities of an organization into a number of separate administrative units over which the managers have authority for the performance of specified activities (Koontz, O’Donnell & Weichrich). The most common form of grouping activities which prevail almost in every institute is the functional departmentalization. The Institute /College work in a comparatively stable environment and have a mechanistic type of organization (Tom Burns & G.M.Stalker, ‘The Management of Innovation’, 1961). In such type of organization, the activities are separated into specialized tasks, and the information flows vertically along the line of authority.

The regular and non-regular activities of the institutes/colleges as discussed in the afore-mentioned paragraphs reveal the existence of the following main departments:

- Principals’ Secretariat
- Cash Department
- Accounts Department
- Registration Department
- Scholarship & Stipend Dept.
- Examination Department
- Enquiry & Verification Dept.
- Academic Council
- Stores Department
- Library & Information Centre
It is also observed that for the smooth running of the institutes/colleges, proper coordination between the various academic and non-academic official functions are activated through the constitution of various Sub-Committees. Each Sub-Committee generally meet at certain intervals and forward recommendations/observations/resolutions to the Principal for perusal. The following are the sub-committees most generally found, the list of which is not exhaustive.

<table>
<thead>
<tr>
<th>Sub-Committee</th>
<th>Function:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admission Sub-Committee</td>
<td>To determine the norms for admission in different classes, review the same as and when required.</td>
</tr>
<tr>
<td></td>
<td>To draw duty chart for teachers during the time of admission.</td>
</tr>
<tr>
<td>Students’ Concession Sub-Committee</td>
<td>To seek application from the poor students and to recommend names of students eligible for financial assistance.</td>
</tr>
<tr>
<td>Academic Sub-Committee</td>
<td>To suggest measures for academic improvements of the college and to co-ordinate among Admission, Time-table, Result Review and examination Sub-Committees, to ensure holding of at least 180 teaching days in an academic year.</td>
</tr>
<tr>
<td>Students’ Disciplinary Sub-Committee</td>
<td>Maintenance of students discipline in the campus, recommend disciplinary action for misbehavior of any student.</td>
</tr>
<tr>
<td>Vocational / Career Oriented Courses’ Sub-Committee</td>
<td>To initiate measures for popularizing the course among the students, suggest names to invite guest lecturers, monitoring of utilization of UGC grants for Vocational Course and preparation of utilization certificate and forward the same to UGC Sub-Committee.</td>
</tr>
<tr>
<td>Library Sub-Committee</td>
<td>To recommend policy decision regarding utilization of UGC/ Govt. grants, books &amp; journals purchase, purchase of furniture for library, procedure for library automation and relevant services in the library.</td>
</tr>
<tr>
<td>Examination Sub-Committee</td>
<td>To recommend date &amp; time table for holding college examinations, asking heads / coordinators of the departments to submit question papers in time, assessing no of answer scripts and loose sheets. The committee will also prepare a chart for Invigilation duties both for college and university examinations.</td>
</tr>
<tr>
<td>Result Review Sub-Committee</td>
<td>To collect marks from heads/ coordinators of the Departments in time, compilation and publication of results and to determine norms for qualifying marks etc. The committee will also review the result of University</td>
</tr>
</tbody>
</table>
examinations for discussion in GB. The committee will also explore the possibility of issuing mark sheets of at least annual examination of the college.

<table>
<thead>
<tr>
<th>Sub-Committee</th>
<th>Function:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Seminar Sub-Committee</strong></td>
<td>To ensure that seminars/workshops etc. are organized in the college by inviting specialist/eminent scholars from various fields. To prepare proposals in prescribed format to UGC for necessary fund.</td>
<td></td>
</tr>
<tr>
<td><strong>Purchase/Tender Sub-Committee</strong></td>
<td>To ensure that bulk purchase of the college are done by inviting tender, to ensure that orders are supplied as per specification, recommend to finance committee for allotment of funds.</td>
<td></td>
</tr>
<tr>
<td><strong>Finance Sub-Committee</strong></td>
<td>To prepare and maintain Budget, to coordinate and control the expenditures and to participate in decision-making on matters related with finance.</td>
<td></td>
</tr>
<tr>
<td><strong>UGC Fund Utilization Sub-Committee</strong></td>
<td>To prepare proposal for UGC grant, utilization of grant received within time, submission of utilization certificate and to maintain asset register.</td>
<td></td>
</tr>
<tr>
<td><strong>Leave Sub-Committee</strong></td>
<td>To prepare and maintain monthly leave account of all staffs &amp; leave statements for approval of GB/Principal as per rules.</td>
<td></td>
</tr>
<tr>
<td><strong>Provident Fund Sub-Committee</strong></td>
<td>To maintain PF account of staff members, assess loan proposals, certify balance, calculate interest of each staff, prepare a PF passbook for each staff, convene an annual meeting of all members to place the individual PF account balance and interest credited together with PF account of the college.</td>
<td></td>
</tr>
<tr>
<td><strong>Students’ Union Election Sub-Committee</strong></td>
<td>To recommend the date of students’ union election, to publish the detailed schedule of election, arranging for issue of nomination forms, scrutiny of forms and to conduct the election.</td>
<td></td>
</tr>
<tr>
<td><strong>SC-ST Cell Sub-Committee</strong></td>
<td>To ensure that rules regarding admission of ST/SC students, recruitment and promotion of ST/SC teaching/non-teaching staffs are done as per rule.</td>
<td></td>
</tr>
<tr>
<td><strong>Building Sub -Committee</strong></td>
<td>To ensure that possession of the building can be made at the earliest, to chalk out a detailed plan regarding the proper utilization of the buildings in the interest of the college.</td>
<td></td>
</tr>
<tr>
<td><strong>Campus Maintenance Sub-Committee</strong></td>
<td>To assess the requirements of repair and maintenance of building, electrical fittings and furniture, to allot rooms for different classes in consultation with Timetable Sub-Committee.</td>
<td></td>
</tr>
</tbody>
</table>
4.2 The Organizational Setup & Re-Controls in Colleges

The provisions as contained in the Statutes and Ordinances are the guidelines for administration that are to be taken into consideration while designing an integrated transaction processing and management information system.

4.2.1 Body Constitution

The Government felt the necessity of prescribing a standard pattern for the constitution of the governing bodies of the government sponsored colleges excepting in cases where the colleges have a special constitution on the basis of Trust Deeds or where the Colleges are run by Missionary Societies on the basis of agreement with the respective missions. After considering the different aspects of the matter and keeping in view the necessity of ensuring the academic interest, it was decided that in supersession of previous orders in the matter of constitution of Governing Bodies of Sponsored Colleges, a standard pattern for the composition of the Governing Bodies of Sponsored Colleges will be followed in all the government controlled colleges. (Details of the prescribed pattern given in Annexure 1).

The Body Constitution of other organizations like open university, tech-institute and research institute are not detailed in this section, as the research work is directed towards model building for affiliated colleges. The members of the ‘Body’ belong to the entity class ‘Other Entities’. The significance of considering this aspect for requirement analysis is to determine and select the homogeneous group of institutions to be incorporated in the institutional-cluster.

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7 Colleges’ Manual – W.B.C.U.T.A. (on reporting authorities)
4.2.2 Re-Control and Supervision of U.G. Colleges *

The rules & regulations that govern the affairs of the colleges form an important part to be considered in requirement analysis. The under-mentioned aspects are examined.

4.2.2.1 The Council for Undergraduate Studies exercise Control and Supervision

It shall be the responsibility of the Council for Undergraduate Studies concerned, acting through the Pro-Vice-Chancellor for Academic Affairs to exercise control and supervision over every college and for that purpose to issue directions so as to ensure:

(a) the provisions of the Act, the Statutes, the Ordinances and the Regulations are regularly and faithfully implemented by the college;

(b) nothing is done by the college either in the administrative or in the academic sphere affecting or tending to affect adversely the functioning of the college as an educational institution;

(c) the resources of the college, including library resources and laboratory equipment, are made available to the students for their instruction;

(d) the financial stability of the college is maintained;

(e) on any other administrative, academic or financial matters, as may, from time to time, is considered necessary and proper.

* The rules and regulations as stated is based on the Statutes and Ordinances of Calcutta University, which may be considered as representative rules & regulations, applicable in general as base level regulations for other Universities and Institutions of Higher Education, compiled in general. The gist presentation of these statutes is to provide a glimpse of the state of affairs and the governance of these colleges or institutes that come under its preview. It is understood that most of these colleges and institutes have a similar pattern of governance as because their basic activities and functions are more or less the same, guided by UGC and DPI. Based on such regulations, ideal workflows of activities that constitute the working of the whole system can be planned. And while planning the workflows, prudent decision has to be taken to decide which activities are to be computerized. The selected activities constitute the parts of the modules as identified in systems requirement analysis.

8 C.U. First Ordinance, 1979, Ordinance 65
4.2.2.2 *Colleges to comply with Directions and submit Reports* 9

Every college shall comply with the directions issued under Ordinance 65 and submit to the respective Council for Undergraduate Studies, through the Pro-Vice-Chancellor for Academic Affairs, reports relating to appointment to teaching posts and changes in the constitution and membership of the Governing Body and such other reports and returns, copies of documents and other papers and information about its affairs and activities as the respective Council for Undergraduate Studies may, from time to time, require.

4.2.2.3 *Books and Records to be maintained by College* 10

Every college shall keep and maintain in proper order the following books and records, namely:-

(a) admission register in such form as the respective Council for Undergraduate Studies may, from time to time, require;

(b) attendance registers of students, teachers and other employees;

(c) student's conduct register showing fines and other punishment imposed, and activities involving breaches of discipline;

(d) register of results of periodical examinations and exercises;

(e) register of transfer certificates issued and received;

(f) cash book and other account books;

(g) service books and character rolls for all employees;

(h) service books and character rolls for all teachers;

(i) a book containing the proceedings of the meetings of the Government Body of the college;

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9 C.U. First Ordinance, 1979, Ordinance 66
10 C.U. First Ordinance, 1979, Ordinance 67
4.2.2.4 **Inspection** ¹¹

(1) Every college shall be inspected on behalf of the University ordinarily once a year and more often when so directed by the Council for Undergraduate Studies concerned.

(2) Such inspection shall be carried out through the Inspecting officers of the university and such other person or persons as may be appointed by the respective council for undergraduate studies for the purpose.

(3) Every college shall keep all books referred to in Ordinance 67 and all other records of the college, including reports of previous inspection, open at all time in the college premises for inspection.

4.2.2.5 **Report of Inspection** ¹²

Any person carrying out an inspection referred to in Ordinance 68 - shall prepare and submit to the Pro-Vice- Chancellor for Academic Affairs a report of such inspection and the Pro-Vice-Chancellor for Academic Affairs shall, after considering the same, forward such report to the Syndicate with his suggestion and recommendation, if any.

*The content of inspection report of a college is shown in Annexure 2.*

4.2.2.6 **Investigation into the Affairs of Colleges** ¹³

(1) If at any time the respective Council for Undergraduate Studies has reasons to believe that proper standards of teaching, training or research are not being maintained in any college or institution, it shall cause an investigation to be made into the affairs of that college or institution by such person or persons as it may appoint for

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¹¹ C.U. .First Ordinance, 1979, Ordinance 68
¹² C.U. .First Ordinance, 1979, Ordinance 69
¹³ C.U. .First Ordinance, 1979, Ordinance 70
the purpose after consulting the views of the Pro-Vice-Chancellor for Academic Affairs.

(2) The Governing Body of the college or institution to the affairs of which such investigation is being made shall - (a) provide all reasonable facilities for making the investigation to the person or persons appointed for the purpose, and (b) submit to such person or persons all registers, records, documents and other papers, including reports and returns, concerning the affairs of the college or institution.

4.2.2.7 Financial Aid

(1) The Syndicate may make grants or advances to a college from University fund or special funds maintained by the University subject to such conditions as it may deem necessary; (2) Such grants or advances shall be made on the basis of proposals submitted by the Pro-Vice-Chancellor for Academic Affairs and recommended by the Finance Committee; (3) Such grants or advances shall be made by the Syndicate for specific purpose, such as improvement of library, laboratory, student's residence, amenities to students and other like matters and shall not ordinarily be made for the normal maintenance of a college.

Along with the implementation of the UGC Scheme for Revision of Pay Scales etc. of University and College teachers, measures to ensure accountability at all levels has been vigorously pursued. A committee with Dr. R. K. Podder, an eminent educationist and administrator, was set up vide Notification No.505-Edu(A) dtd. 12.08.1999 to suggest measures which were required to be taken to ensure accountability of staff for maintaining high academic standards and good institutional governance.

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14 C.U. First Ordinance, 1979, Ordinance 71
4.2.2.8 **Audit of Accounts**\(^{15}\)

Audit of the accounts of the accounts of the college should be undertaken immediately and completed within three months from the date of appointment letter by the auditor. One copy of the report is to be submitted to the Directorate within one month from the date of completion of the audit and two copies of the audit reports to the college authorities.

The contents of Auditor’ Report constitute a major part of management information to be generated, which may be identified for incorporation as ‘fields’ for the database through systems requirement analysis. The content of the Auditors’ Report is listed in **Annexure 3**.

4.3 **Feasibility Study for Mechanization of Institutional Governance**

Keeping in view the current dynamic background in higher education system, a feasibility analysis for mechanizing the basic recurring natured but non-decision-making activities of a college or educational institute was undertaken in the research.

Feasibility analysis is the test of the system proposal according to its workability, impact on the organization, ability to meet user needs and effective use of resource. Technical, economical and operational feasibility studies were made in the research to find justification of mechanization and construction of management information system.

4.3.1 **Technical Feasibility**

In feasibility analysis, the technical feasibility analyzes the merits of the system from the technological point of view. It provides information about the performance,
reliability, maintainability, productivity, and reusability of the product. Technical study points out which technology is suitable for the system’s performance, what methods, algorithms, and processes are required.

The technical issues raised during the feasibility stage of the investigation include:

1. Does the necessary technology exist to do what is suggested (and can it be acquired)?
2. Does the proposed equipment have the technical capacity to hold the data required to use the new system?
3. Will the proposed system provide adequate responses to inquiries, regardless of the number or location of users?
4. Can the system be expanded in future if required?
5. Are there technical guarantees of accuracy, reliability, ease of access and data security?

The possible end-product/s of the present study is intended for users who are expected to have workable knowledge in computing. They may at best be willing to undergo a short training to use the software. The proposed system should run on low cost micro-computer or on personal computer with user-friendly Graphical User Interface in DOS /Windows environment, though the use of UNIX / LINUX is not ruled out. Similarly, there is no bar on the use of a mini-computer, preference will be for standard PC Hardware. In LAN environment, sets of hardware may be connected together with Hubs/Switches, preferably in wi-fi net environment.

Considering the Stand-Alone mode of operation, the operating system that can be used is Windows XP or higher that supports Oracle or SQL Server as backend database. Visual Basic could be chosen as the language for interface designing with
verifications and validation check options. For expanding the scope of operation in future by interlinking the databases of various institutions through Net, ‘Active Server Pages’ (an open application environment in which HTML pages, scripts, and ActiveX components can be combined to create Web-based applications) may be considered. ASP was designed to simplify the development of Web server applications: programs that run on the server and interact with the client. The most important applications one build with ASP are applications that extract data from databases on the server, format them with HTML tags, and returns them as new HTML pages to the client. With Active Server Pages, one can use the ActiveX Data Objects (ADO) of the Database component to access the database, possibly process the data, and then format them as HTML tables. The ADO uses the ODBC drivers, and can access all databases supported by ODBC. These facilities are considered helpful while thinking for integrating the databases of various institutions/colleges through Web.

Thus we can conclude that the project under consideration is technically feasible which can guarantee accuracy, reliability, ease of access and have adequate data security features. It has the scope to be expanded in future. It could offer the scope of Data Warehousing. And above all, the system may be very user-friendly with adequate super-user controls.

4.3.2 Financial Feasibility

In feasibility analysis, the most important analysis is the financial or economic analysis. It is actually the cost benefit analysis. Here, it is done to justify the establishment of a computer based system. Economic analysis gives the idea of the cost of project development and compares it with the benefits that may derive from the system.
Costs associated with the development of a system are *Procurement Costs* (which consist of the costs for consultation, equipment purchase & equipment installation), *Start-up Costs* (which consist the costs for Operating System software, start-up personnel management expenses), *Project related costs* (which consists the costs for purchase of software, modification of software to fit the local system, personnel, overhead, etc. from in-house application development, training of user of the system, data collection, preparation of document and development of management), and *Ongoing Costs* (which consists the costs for systems maintenance – both hardware & software, hardware & software depreciation, pays of staff involved in system management, operation and planning activities). Though costs are easily quantified, the benefits are not always quantifiable. However, the tangible and intangible benefits can be enumerated and converted to some equivalent costs for justification.

From experience, it is often found that the accuracy of data so derived, high speed of operation and the possibility of the database to be consolidated with the master database of a Central Controlling Center for better management information system can give greater benefits than the cost that are needed to be incurred.

Development of a system is economically or financially feasible when :-

*Cost prior to introduction of the system ÷ estimated costs for introducing new system > 1.*

In the present study, this ratio is expected to be greater than one, especially when one consider the time saved from recurring natured repetitive jobs and lesser clerical mistakes, and of course for fast processing of data. Considering these, we may conclude that it is economically feasible to go for mechanizing a part of the institution’s administrative system that are of repetitive nature and belong to strategic natured jobs in clustered collaborative system.
4.3.3 Operational Feasibility

Operational Feasibility asks if the system will work when it is developed and installed. And whether there are major barriers to implementation. At present, the situation is changing as people learn more about computing. Users (here, meaning administrators and staff of the institutions) are becoming highly involved in systems development for several reasons:

1. Users have accumulated experience from working with generalized applications that were developed for them earlier. They have better insight into what information systems help means and how it can be obtained. If they have experienced systems failures, they have also formed ideas about avoiding problems.

2. Microcomputers, in the form of workstations, personal computers, or home computers, and software that meets the users needs, whether for business requirements or personnel management necessities, have become cheaper and readily available.

3. Users entering organizations today frequently have adequate introductory knowledge on computer applications. Better systems development tools are emerging to take care of complex user’s requirements in lesser time and efforts, thus resulting in cheaper rates for system development and its implementation. Because of the fast and accurate processing capability, and because of its inherent economy, the institutional administrators are increasingly becoming interested to take the help of information technology to do their routine administrative and accounting jobs, particularly in the environment where there is lesser personnel recruitments because of the government’s fiscal policies and increasing workload.

Considering the present day situation (based on personal interviews and observations), it is expected that there will be sufficient support for mechanization of
the administrative works from the management and staff. It is true that the present manual system is well liked and used in many places, and there are people who see no reasons for a change, yet the inherent advantages in the new mechanized system, i.e. its high processing speed, accuracy and economy that is distinctly visible elsewhere will motivate the conservative minded users to become interested with the new mechanized system to produce information through a result-oriented management information system.

Another important consideration is how to involve the operational staff in the new mechanized system. From observations, it is felt that if the grass-root level users are been involved in the planning and development of the project right from the beginning, there is better chance for the project to cover finer details of the works that could only be known through years of practical working experience at grass-root level. Side-by-side, the detailed operational procedures in the new system would be readily known to them naturally because of their involvements in the process. There may be some well-planned guided-practice workshops and training programs for them. Moreover, their personal involvements would certainly nourish some sort of sentiment and affection towards the new system that would reduce the chances of resistance to the changed system.

Another fundamental question arises. That is, whether it would be possible to carry on with the new mechanized system once it has been installed and become operative. As we understand, a college or an educational institute has a perpetual succession in its entity, and its administrative works cannot be detained for even a single day. Now if a new system is installed and after running successfully for a certain period with the active and participative help of the system developer (who becomes the key-man),
stops working because of the absence of the key-man for whatsoever reason it may be, we can definitely say that the proposed system will cause harm to the organization. It will bring the organization down to the ground because of human created technical bottlenecks. In other words, the institution has a chance to loose control over its day-to-day operations because of its dependence in the hands of a system developer who is an outsider to the organization and on whom, the institution has very little control to exercise. Then the determining question is what actually the system developer can do so that the control remains in his /her hand even after the delivery of the software that is developed and successfully installed in the institution.

If the system analysis and design (for an educational institute or a college) prescribe for a front-end application with a back-end database, a database connectivity has to be created using some Database Control mechanism, for which specific path has to be defined. There are chances that the system developer defines those paths not through codes but through property windows separately (as is common in Visual Basic with Oracle or SQL or even MS Access as its back-end). So every time the application software is newly installed on a computer, those path-settings have to be made separately each and every time. And such settings can only be done if one can open the relevant code-sheets. But since the system-developer usually deliver the EXE-file of the software, such code-sheets are not available to the administrators of the institution. Moreover, developers now-a-days take the help of various DLL files to work with their projects in faster pace. There are chances that those DLL files are kept in different hidden locations in the hard-disk (and not within the software package) and the main code sheets contain the path addresses. In such situations, unless all the DLL files are separately installed in their specified paths on the computer’s hard-disk, the relevant portions of the software will not work. The
database, which is normally protected through a password is needed to be opened sometimes for data-recovery, data-back-up or data-editing purposes. The accessibility of the database to the institution’s administrator is therefore a necessity. But handing over all these technical control mechanisms by the system developer to the head of the institution to honour ‘built-and-transfer’ contract is not always possible, especially in low budgeted contracts.

Considering all the factors as stated above, we can conclude that there is operational feasibility for implementing uniform mechanized office maintenance system in college /educational institute only when:

- the complete transfer of technology is done through ‘built-and-transfer’ contract, whereby it is ensured that the code-sheet and the entire software package is delivered,
- yearly contract for maintenance and updating the system is undertaken with the system developer,
- organization-specific analysis, design and development of the software be made, taking into consideration the hard-core experience of the operational staff,
- adequate training of operational staff be planned and implemented through the system developer,
- and finally, the internal staff be involved in the system development process right from the beginning, so that they can get into the new system and get themselves well acquainted with the changes.
4.4 Requirement Analysis and Specifications

Requirement analysis and specification of functions are needed to identify the scope of the operational level of the project. The criteria of selecting activities that need computerization are that they must be of recurring-nature, repetitive but non-decision-making works.

4.4.1 Requirement Analysis

Requirement analysis involves the determination of what exactly the end-user wants from the system. Often the users may want ‘computerization’, but it has to be spelt out in sufficient details – the extent of computerization (full / partial), the kind of response needed (fast / slow), or the intensity of implementation (organization wise or unit wise), etc. After specifying these parameters, the overall business goals must be spelt out. For example, considering the processing of Student Registration and Student Grade in a typical educational institution, it can be said that since the activities are data intensive, time critical and error prone operations, it is a prime candidate for computerization. The requirements of a computerized system would therefore be the followings:

- An almost error-free and secure operation
- Very fast processing
- Cost effective, with emphasis on low cost
- Activities which are of repetitive nature and require little decision-making
- Potentiality of the outputs so generated through the mechanized office maintenance system to find place in integrated and consolidated management information system.

The determination of requirement thus includes studying the existing system and collecting data about it to find out what the requirements are. This activity has been carried out in two phases:
• Detailed investigation on the functions and output requirements
• Determination of system requirements

The heart of systems analysis is aimed at having a detailed understanding of all the important facets of the project under consideration. For this, interviewing technique was used through purposive sampling method, where the user groups as well as the management were interviewed in informal and unstructured form (through questionnaire as in Annexure 8) followed by summarization of observations (as presented in Annexure 9). It involved extensive survey by way of frequent visits to various Colleges and Institutions, Libraries, DPI offices, University offices, and to Software labs. The study of manuals and reports, actual observation of work activities and collection of forms and documents to fully understand the system were undertaken. The study aimed to cover the following points:

(a) Frequency of the occurrence of activities
(b) Work-process of the activity
(c) Operational bottlenecks and its potential causes
(d) Information the system should produce
(e) Processing controls
(f) Inputs and outputs

A detailed check-list of the different activities that an institute or college have to perform regularly is mentioned in Section 4.1.1 to 4.1.3. Based on that check-list, and also reviewing the Document Requirements of DPI (in Annexure 10) and Information Requirements for Annual Quality Assurance Report (AQAR) (Annexure 11), the under mentioned areas of operation are identified in the institutions / colleges which are of recurring-nature, repetitive but non-decision-making works, for which computerization is considered beneficial:-

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- Library Administration
- Students’ Administration (including Admission, Fee Collection, Examination, Attendance, Routine, Change of subject, Students’ Personal Records)
- Staff Administration (including Payroll, Personal Records, Attendance & Leave Records, Duty Allocation Diary, Service Book)
- Finance Accounts & General Administration
  (including Budget, Income/Expenditure, Tax, PF, Final Accounts)

4.4.2 Output Requirements

The technique of requirement elicitation used in this study is the interviewing technique, where the user-groups as well as the management are interviewed in informal and unstructured form followed by formal presentations. It involved extensive survey by way of frequent visits to various colleges and institutions, libraries, DPI offices, University offices, and to software labs. Total number of such visits so far made during the period is 95. Total number of soft-copies of relevant working files collected and summarized so far numbered 1019. Based on the survey, the output requirements (covering the points as mentioned in Annexures 10 and 11), of most of the institutes/colleges are summarized to be covered in the following modules of activities related with office management:

Module 1. Staff Administration

Module 2. Finance Accounts & General Administration

Module 3. Students’ Administration

Module 4. Library Management

Module 5. Management Information

Module U. Utilities
The above modules may be enveloped in a ‘Main Menu’ through a Menu Editor. A sub-menu ‘Monitor’, may be included to look after the authentication and security management works. A detailed list of the various sub-functions of the different modules, are presented hereunder. The sub-functions may be either to add input data into the system or to generate some output from the system, or a combination of both.

A detailed list of output requirements may be shown as below :-

**Monitor**

.... Super User
.... User-Staff Administration
.... User-Finance & Accounts
.... User-Student Administration
.... User-Library Management
.... User-MIS
.... Help
.... EXIT

**Staff Administration**

.... Personnel Info
........ Teaching
............ Master Info
............ Academic Diary
............ Leave Register
............ Service Book
............ Pension Book
........ Non-teaching
............ Master Info
............ Leave Register
............ Service Book
............ Pension Book

**Payroll**

........ Basic Inputs
........... Basic Pay
............ Other info inputs
............ Check-list of month’s transactions
Generate Reports

Pay Demand Bill (DPI)

Acquaintance Roll

Pay-slip

Annual Salary Statement - employee-wise

Abstract of Pay

PF Ledger

Closing Balance Transfer to Opening

Transaction Confirm

Advances & Recovery

Interest Calculation

Individual

College Abstract

Treasury Abstract

Deposits

Withdrawal

Ledger Report Generation

Monthly Deposits

Monthly Ledger

Yearly ledger

Report employee-wise

Income Tax

Tax Calculation

NSC Interest Calculation

Form 16

Form 24

Finance Account & General

File

Change Financial Year

Enter New / Edit Organization Details

Save Back-up of Data

Retrieve Back-up of Data

Compact the Database

Accounts Master

Create New Accounts Head
…….. Edit Accounts Head
…….. Delete Accounts Head

.... Transactions
…….. Enter New Transaction
………… Misc. Receipts
………… Misc. Payments
………… Contra Entries
………… Journal Proper
………… Security Deposit
………… Caution Money Deposit (Student’s)

...... Transfer Balance Heads
………… From Students’ Fee Collection
………… From Library’s Fine Collection
………… From Acquaintance Roll Summary

…….. View Entries Date-wise

…….. End of Year Procedure Execute

.... Reports
…….. Annual Budget
…….. Cash Book
…….. Bank Book
………… Bank (1)
………… Bank (2), (etc.)

…….. Fee Collection
………… Daily
………… Monthly
………… Annual Abstract Head-wise

…….. Ledgers
………… Balances
………… Details

…….. Receipt & Payment (Cash Trial)
…….. Trial Balance
…….. Income & Expenditure Account
…….. Schedules & Annexure
…….. Audit Compliance Reports


**Students’ Administration**

.... **Student Info**

....... Admission-Year-wise

....... Edit Info

....... Students’ ID Issue

.... **Masters**

....... Course Master

....... Subject /Group Master

....... Students’ Fee Master

.... **Students’ Transfer**

....... Update Record

....... Print Transfer Certificate

.... **Student’s Stream Change**

....... Add/ Edit/ Delete

....... List

.... **Students’ Attendance**

....... Entry month-wise

....... Attendance Report -class-wise

.... **Admission**

....... Form Entry

............ Form Editing/Correction

....... University Registration Record

....... Students’ General Register

............ Search Students’ Info

............ Enter New Students

............ View New Students’ List

............... Class-wise

............... Subject-wise

............... Backup (Out-going Students)

....... Applicable Fee Structure

....... Subject Combination setting

.... **Student’s Fees**

....... Fee Collection Received

....... Fee Refund

....... Fee Concession/Scholarship

....... Credit memo Navigator

....... Reports

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………… Daily Collection Statement
………… Monthly Collection Summary
………… Yearly Collection Summary
………… Students’ Fee Collection Ledger
………… Defaulters’ List
………… Fee Payment Status (On Ledger)

…..Examinations

…….. Internal

…………...Yearly Schedule / Roster
………… Results

……………… Marks Entry Subject-wise
……………… Marks Consolidation Student-wise
……………… Reports
……………… Mark List
……………… Promotion List
……………… Students’ Performance Report

…….. External

…………… Form Fill-Up Students’ List
…………… Admit Card Issue Students’ List
…………… University Exam Results Student-wise

…. Alumni Association

…….. Add/Edit Members’ Profile

…….. Employment Status Search/Report

…….. Fund Accounting

…. Special Reports

…….. Print Students’ ID Card

…….. Students’ List

……………… Current Students Caste-wise

……………… Current Students Subject/Combination-wise

……………… Current Students Subject/Combination/Hons/General-wise

……………… List of Transferred/Cancelled Students

……………… Students General Info ID No.-wise

…….. Payment Reports

……………… Payment Status (on Ledger)

……………… Fee Pay Structure Subject/combination-wise

……………… Daily Fee Collection

……………… Payment Report- Individual Students’
Library Management

.... Master Database

....... Subject Master

............. Add/ Edit/ Delete

............. List

....... Sub-type Subject Master

............. Add/ Edit/ Delete

............. List

....... Author Master

............. Add/ Edit/ Delete

............. List

....... Publisher Master

............. Add/ Edit/ Delete

............. List

....... Member Master

............. Staff (Teaching/NT)

............... Add/ Edit/ Delete

............... List

............. Students

............... Add/ Edit/ Delete

............... List

....... Books Master

............... Add/ Edit/ Delete

............... List

....... Journal Master

............... Add/ Edit/ Delete

............... List

.... Library Transactions

....... Issue Books/ Journals

....... Reserve Books/ Journals

....... Return/ Re-issue Books/ Journals

....... Requisition

....... Missing Books/ Journals Adjustments

....... Security Deposit Credit/ Debit

....... Scanned Documents/ Articles’ Archive

.... Search Books

....... By Author
..... By Subject
..... By Title
..... By Book ID No.
..... Search Articles/ Journals
..... By Author
..... By Subject
..... By Title
..... By Journal ID No.
..... Reports
..... Member Register
..... Book List
........... Subject-wise
........... Author-wise
........... Publisher-wise
..... Catalogue printing
..... Requisition List
..... Book Stock Status
..... Member Status
..... Security Deposit Schedule
..... Fine Paid List
..... Fine Outstanding List
..... Missing Books List
..... Books Issued (Date-to-date)
..... Books Returned (Date-to-date)
..... Books Out
..... Journals Issued (Date-to-date)
..... Journals Returned (Date-to-date)
..... Journals Out
..... Defaulter’s List
..... Book Issue Status

Management Information
.... For College/Institution’s own use
.... For University
.... For UGC
.... For DPI
.... For Banks
Utilities
.... Address Book
.... Annual Calendar
........ Academic
........ Administrative
.... Drafting Wizard
........ Letters
........ Reports
........... Financial
........... Performance
.... Data Back-up Wizard
.... Change Accounting Year

From the hierarchical list as shown above, it can be observed that many files and records are maintained and called for at multiple point of time by various users of information. In such case, there is a strong need for normalization. A single set of database has to be designed, where, from various input interfaces, data can be filtered in to generate the desired outputs. At this point, there is need to classify the output reports that can be developed as the text documents, worksheets and data-base generated reports. The logic for taking such decisions may be that the fields that would occur repeatedly in many places can be taken to design the normalized database, from where various reports can generate. The other reports that are required often but have diverse fields and formats may be kept separately in a directory, and suitable mechanism by way of Object Linking & Embedding Technique may be applied to create new templates in ‘Save As’ mode, of the existing file present in the parent directory in Text or Spreadsheet or in other format.

For management information purpose, the output requirement are those which are :-

- Recurring natured strategic information for top management,
- Recurring natured office information for middle and low level management,
• General information not needing human expertise for special analysis,
• Routine information generated from inputs entered through Transaction Processing System, for which no additional input data entry is required.
• Strategic information for institutional control in cluster environment.

4.4.3 The System Requirements

For implementing the project, the following requirements from the user’s point of view has to be considered:

• The software must be multi-user, modular, and must have Access Level Protection with user permission control.
• The system and the database should be highly secured.
• Operational support and regular up gradation of the software by the system developer is needed.
• Interface must be user-friendly through GUI interfaced functional menus.
• The system requirement for each unit in the ‘cluster institutions’ include:
  1. Stand alone clients (desktop PC) interconnected through LAN, and a Central Local Server of higher configurations.
  2. Printer LAN connected,
  3. Scanners & Plotters of standard configurations,
  4. Operating System : Windows / NT / UNIX / LINUX,
  5. Front end Interfaces : Visual Basic / Java
• The distributed database of all the ‘cluster institutions’ combined together must contain a set of database tables of same specification uniformly designed in Server-Client Model, to be situated in the institution and operated by them. They
may be called the ‘Local Centre Databases’. There must be a System Administrator to consolidate the ‘Local Centre Databases’ through a Central Server of the ‘cluster-institutions’, and to generate the specified services and management information on behalf of the ‘cluster institutions’.

4.5 System Design of Functional Modules

The design of a system uses the functional specifications as the basis, and produces the details that state how a system will meet the requirements identified through system analysis. With systems being subject to constant change, reusing components of existing system and building newer system is a necessity. An object-oriented approach is a more natural way of dealing with the user-oriented system like that of our present one. While designing the functional modules of this project, the following aspects are reviewed:

- identification of outputs,
- data structure designs
- data processing flow charts and data flow diagrams.

The functional modules that need integration through a Transaction Processing System to generate Management Information at various levels are therefore identified in this research study as Staff Administration, Finance Accounts & General Administration, Student Administration and Library Management.

4.5.1 System Design of Staff Administration Module

Staff Administration Module is aimed to create a HR database which may include the establishment records of the staff and the related functional data. We have identified the following functions in this Module that need computerization.
They include:

- Maintenance of Staff Information (including Performance Appraisal and Leave Records)
- Payroll Management (including Salary Statements, Income Tax Returns and DPI Claims) including PF Administration.

Another important function related with staff matter is the compilation of Pension Returns. But since this activity is of non-recurring nature and only take place when a staff attain his/her retirement age, this activity is not included in our proposed module. But provisions are made to store the details of information that are needed to prepare the various pension returns.

4.5.1.1 Maintenance of Staff Information

Information regarding staff in the organization is necessary for generation of numerous reports particularly for the Payroll, Finance & Accounts and MIS modules, and for the purpose of generation of pension papers. Maintaining and generating such reports may be organized through the following sub-menus.

.......... Teaching Staff
.......... Master Info
.......... Academic Diary
.......... Leave Register
.......... Service Book
.......... Pension Book

.......... Non-teaching Staff
.......... Master Info
.......... Leave Register
.......... Service Book
.......... Pension Book
The staff file should include the following important papers:

1. Scanned copy of appointment & joining letter
2. G.B. Resolutions regarding appointment, confirmation, pay fixation, grant of leaves, and others
3. Post creation government orders
4. Pay fixation memos
5. P.F. ledger & returns
6. Service details and confidential reports (Service Book)
7. Details of academic activities for teaching staff (Academic Diary)
8. Attendant register records
9. Leave records
10. Personal bio-data of staff with supporting papers
11. Specimen signature record
12. CPF/ GPF, Pension and Gratuity information

4.5.1.2 System Design of Payroll Management Module

The payroll contains the payment details of the employees for their service rendered to the institution. The records in a payroll are usually called for on the basis of the employee id-number and institution id-number. A Payroll System may generate the following major outputs:

(A) DPI Claim Statement
(B) Pay Slip & Salary-Statement
(C) Acquaintance Roll
(D) Provident Fund
(E) Tax Summary Registrar

The workflow of the payroll process as present in the government aided college is described below:

On appointment, a form containing all the employee’s basic details are entered in Employee Register and separate files are opened for each of them that contain the
personnel documents, including DPI memos. Any new change is also recorded. Initiatives are taken to send the pay fixation memo along with relevant papers to DPI; and to confirm the position of the newly recruited employee after a certain period, usually one year. A week before the end of each month, the attendance register/s and advance salary voucher details of the employees are send to the administrative department. Considering the Basic Pay and the date of increment, the monthly payroll statement is prepared. This statement is used as the basis for preparing Pay-slip, Bank statement, Salary Abstract, Acquaintance Roll, DPI claim, Tax summary, Form 16 & 24 (once every year). There may be instances when the figures appearing in the pay-slip do not tally with the payroll statement or the bank statement, or, the figures appearing in the bank statement are wrong, or, the salary summary statement does not tally. Internal check system by way of validation checks is maintained.

As the College/ Institute has to depend on the Directorate of Public Instructions (DPI) for salary of its staff (both teaching and non-teaching), it has to send monthly statement of ‘Claim for Pay & Allowances’, along with other relevant papers, like, Abstract of Pay & Allowance Requirements, 10-Point Certificate, copies of Acquaintance Roll, HRA Declaration, Disbursement Certificate, Audit Report, T.R. Form No.7, etc.. When the Pay Packet bill is sanctioned, the T.R. Form No. 7 or the Challan Form is deposited to the Treasury/Bank, along with a Form for Consolidated Grants-in-Aid-Bill-cum-Cheque-Slip drawing salary/grants for teaching /non-teaching staff of the institute.

The important pay rules & norms that are to be taken into consideration in Payroll Management for the Colleges in West Bengal, are given in Annexure 4.
A Context Diagram to illustrate the workflow of relationships that are present in payroll module of colleges is shown in Figure 4.2.

Fig. 4.2 Context Diagram showing relationships in Payroll Management System

The above Context Diagram shows that the new employee details and bank details are entered in the master database. The administrative department feed the system with attendance details and employee details, which are updated. The Accounts department gives the salary detail and receives the accounts statement from the system. The salary abstract is received by the administrative department. The bank receives the bank advice for salary payment to staff. The employees receive the pay-slips. The major reports (outputs) from Payroll Module are:

- Pay Demand Bill (DPI)
- Acquaintance Roll
- Pay-slip
- Annual Salary Statement - employee-wise
- Abstract of Pay
- P.F. Ledger
The payroll relationship scenario as illustrated in the Context Diagram is further elaborated through a Structure Chart as shown in Figure 4.3.

![Fig. 4.3 Structure Chart showing transaction processing in Payroll Management System](image)

The algorithm for the generation of output statements (as shown in the Structure Diagram above) may be summarized below:

1. **Retrieve the information employee-wise stored in the basic_master through the forms ‘teachers.frm’ and ‘non-teacher.frm’**.
2. **Retrieve the pay-scale through the form ‘salaryps.frm’. Check whether**
the payslip is already generated.

3. Enter the allowances and calculate the balance through the form ‘allowances.frm’. Check, if the allowances are present. If not, retrieve the allowances and recovery from ‘allowances.mdb’.

4. Select the month from ‘yeardata.mdb’.

5. Enter the deductions.

6. NetPay is calculated using the formula ‘sum( )’.

7. Save the data in the ‘acquaitanceroll.mdb’ month-wise, and generate payslip employee-wise, which may be saved in html and/or in xls format.

8. Generate the Salary Statement for one complete year employee-wise, and transfer the document to spreadsheet (saved in xls format).

9. Generate the Acquaintance Roll of all the staff month-wise showing in details the basic_pay, allowances and the deductions.

10. Generate the Abstract of Pay of all staff head-wise for the month.

As the ‘system design’ of Payroll Management System aims towards integration with Human Resource Module of Educational Institution’s ERP System and make it operate in Cluster Institutional environment, provision must be kept to make it a part of Human Resource Module. In order to link these activities, a book keeping work is needed, which can be done by a separate module named User-Accounts Manager. In such an arrangement, HR Module transfer data like employee payment, deductions, DPI claim reports, etc. to User-Accounts Manager, to be filtered, consolidated and shared by the assigned user. The important aspect in this system is that a monitoring system is installed to play the role of a ‘Systems Administrator’ who will have the authority of registering several users who will operate in the system after getting their identity authenticated in the different sub-modules through their User ID and Password assigned to them. For such an arrangement, uniform payroll software has to be installed in all the offices of the cluster-members that have all the compatible features to be used in multi-location based cluster-institutions.
The flow of the documents in the payroll module may be illustrated by way of the First Level Data Flow Diagram as shown in Figure 4.4.

![First Level DFD of Payroll Management System](image-url)
The first level data flow diagram as shown above may be further analyzed intensively through second level DFD as shown in Figure 4.5 below.

Fig. 4.5 Second level DFD of System Monitoring Module of Payroll Management

The integrated Payroll Management System may include Personnel Administration, Payroll Accounting and Personnel Planning & Development schedules. There may be a global HR data structure normalized and accessible to all the entities in the cluster who are granted permission to enter the system. Original documents including employee photographs can be scanned into optical storage by using SAP Archive Link. This system can have the provision to display personnel data in graphical format such as organization charts or as employee data using the reporting facilities. The Basic Input Processing activity may be further segregated into Master Employee Pay
Details maintenance works, Transaction Pay Details maintenance works and Net Pay generation works, the outputs of which may be stored in distributed databases to be used further as the inputs to generate output documents under M.I.S. These processes are illustrated through the following second level DFD in Figure 4.6.

Fig. 4.6: Second level DFD of Basic Inputs Processing Module of Payroll Management System

Finally the ‘output-reports generation’ stage is reached in the system after completion of the works of the Basic Inputs Processing Module, as shown in DFD in Figure 4.7.
Fig. 4.7: Second level DFD of Report Generation Module of Payroll Management System
An overall Input-Output Summary related with DPI Claims and Salary Roll generation may thus be shown in Figure 4.8.

![Fig. 4.8 Input-Output Summary of Payroll Module](image)

The second level DFDs may be further extended to third level DFDs to show strategically important output generation processes that are relevant to M.I.S. The most important of such output documents are presented below.

A. **DPI Claim Report & Pay Statements**

Using spreadsheet concept, DPI Claim Statement of twelve months may be designed with 12 output-worksheets and 1 input-worksheet. The input worksheet may be designed as such it auto-generate the basic pay of an employee for 12 months after taking into consideration the date of increment, increment pay and pay-ceiling. In such an input worksheet, it will be needed to confirm the basic pay for the first month only, while the basic pay of other months will be auto-calculated. This can be done by applying formula in the cell which represent the month of increment, while the other months may be linked with that of the previous months. Using DBMS concept, the following process logic may be adopted:

1. **To retrieve the employee information from employee_master.mbd and basic_master.mbd.**
2. **To check if the designation or salary_scale changes during the claim date. If changes, then to update the basic_master.mbd and employee_master.mbd using the formulas as stated above.**
3. To run the program package to generate the output form, and after confirming the start-basic-pay for the year.
4. To save the output of newly generated report in database file named dpi.mdb.
5. To transfer the data to Spreadsheet application or Crystal Report for getting the output in printable form.

The data flow and the process logic of its generation may be presented by way of a third level DFD as shown in Figure 4.9.

![DFD Diagram](image-url)

**Fig. 4.9** DFD of DPI Claim Summary Report generation
B. **Tax Summary Registrar and Tax Forms**

Another strategically important output is the generation of *Tax Summary Registrar and Tax Forms*. The algorithm of its process is presented below.

1. Retrieve the information from Payroll module and Employee Master.
2. Select the financial year and the date from database.
3. Retrieve the GrossPay, bonus and other deductions from Payroll module.
4. Enter other information, like tax-saving-investments, tax-benefits u/s 80, etc.
4. Calculate the net deductions and save it in tax summary register.
5. Save the entire tax summary database as taxsummary.mdb.
6. Transfer the data of taxsummary.mdb month-wise to spreadsheet for report generation.
7. Calculate the taxable income as per current norms.
7. Select the Rebate type and enter the rebate amount.
8. Retrieve the TDS from Payroll module. Subtract from the above to find out income due / refundable.
9. Create a view through a query and transfer the data to applications for report generation.

The data flow of this sub-module may be as presented in *Figure 4.10*.

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Fig. 4.10 : 3rd Level DFD showing the generation of tax related documents


C.  

**Generation of PF Statements & Register**

In College administration, the management of the P.F. Fund is vested in a Committee called the Provident Fund Committee. Every confirmed employee, teaching or non-teaching, holding a permanent whole-time appointment subscribe monthly to the Fund, which is keep in a ledger account showing the amount at the credit of each subscriber, and audited every year. The P.F. Contributions are deposited in the State Treasury through (T.R.) Challans. So the output requirements from this sub-module are Provident Fund Statements Employee-wise, generated T.R. Challan and the P.F. Register. The algorithm of the work process may be described as below.

1. **Each month, the closing balance of ‘Gross’ and ‘O/S Loan’ so generated through formulas has to be transferred to next month as opening balance, after proper backup of the closing balances month-wise.**

   The important formulae that are relevant in P.F. calculations are:

   - **Op_Gross + Cont + Int_Contribution = Clo_Gross**
   - **Op_O/S_Loan + Loan_given – Recy_Loan = Clo_O/S_Loan**
   - **Clo_Gross + Int_Loan - Clo_O/S_Loan = Clo_Net_Bal**

   (All closing balance transferred to next month as opening balance.)

2. **From ‘Employee_Master’ database, to call the following fields:**

   - `emp_id`, `emp_name`, `PF_a/c_no`.

3. **From ‘Pay_Deductions’ database, to call the following fields:**

   - `PF_Contribution`, `PF_Loan_Recy`, `PF_Loan_Int`, `mmyyyy`, `emp_id`.

4. **In the ‘PF_Trans’ database, make data-entry (if arises) of PF_Loan given along with Loan Sanction No.**

   Data Tables / Fields identified:

   - **PFCASH**  
     
     [ `pfcashdt date(8), empcode c(4), cont_cash n(10.2), amt n(10.2), mt_cash n(2), yr_cash n(4) ]

   - **PFADV**

     [ `pfadvdt date(8), empcode c(4), amt n(10.2), mt_adv n(2), yr_adv n(4), tradvdt date(8) ]

   - **PFWITHDRAW**

     [ `pfwithdt date(8), empcode c(4), amt n(10.2), mt_adv n(2), yr_adv n(4), trwithdt date(8) ]

   - **PFINT**

     [ `pfintdt date(8), empcode c(4), perint c(15), amt n(10.2), mt_int n(2), yr_int n(4) ]

   - **PFINTDEDN**

     [ `rate_int n(5.2), gpfded n(5.2), cpfded n(5.2), limit_revenue n(8.2) ]

5. **To confirm through validation checks the inputs of current month’s transactions, namely, ‘PF_Contribution’, ‘Loan_Given’, ‘Recy_Loan’, and ‘Int_Loan’, before the Reports are generated.**

6. **To generate the reports.**
4.5.2 System Design of Finance Accounts & General Administration Module

For generating management information, a major data source is that from the Finance & Accounts Module. This justifies its integration in the Management Information System of cluster-institutions. The Finance & Accounts Section (which also include General / Office Establishment Section in this study, and henceforth be called **F A & G Module**) of the educational institutions generally look after the tasks which include:

1. **Preparation of Annual Budget,**
3. **Maintenance of Voucher files – Cash payment, Bank payment, salary payment & deduction, contra transaction (of petty cash and deposit /withdrawal to/from banks),**
4. **Maintenance of Journal Proper & General Ledger Accounts Books,**
5. **Maintenance of Students’ Admission Register,**
6. **Maintenance of Fee Collection Register and Students’ Fee Book counterfoils,**
7. **Maintenance of files of Pay & Accounts Bill month-wise, DPI’s sanctioned memos, copies of disbursement certificates, and salary sheets,**
8. **Maintenance of Security Deposit & Caution Money Accounts,**
9. **Preparation of Fund Utilization Reports of sanctioned projects,**
10. **Preparation of Bank Reconciliation Statements, Cash Trial and Trial Balance Statements, Final Accounts, which include Income & Expenditure Accounts, Balance Sheet and Schedules to Final Accounts,**
11. **Compilation of Audit Compliance Reports,**
12. **Maintenance of Provident Fund Register,**
13. **Maintenance of Tax Summary Register.**

The **F, A & G Module** normally generate transactions that include:

*Receipts:* from students as fees under various heads, donation receipts, grant-in-aids from bodies like UGC, DPI & others, donations and project assistance grants;
*Payments:* of revenue nature and capital nature;
*Deposits:* to banks, provident fund organization, tax authorities;
*Withdrawals:* of funds from banks and provident fund organization;
*Adjustment, Rectification & Contra Entries:* through journal vouchers.
The F, A & G Module may be considered a part of the Transaction Processing System. Data entered through this module may be validated and stored in a relational database through various normalized ‘Input Menus’ designed in the Application Software Package. Such data may then be called in through RDBMS program packages to generate various M.I.S. Statements & Reports. The relevant head of accounts identified to be included in the design of a DBMS for this module is listed, as presented in *Annexure 5*. The outputs include seven schedules (presented in *Annexure 6*) along with the books of accounts and final accounts.

The workflow of the activities in *F, A & G Department* may be summarized as below.

1. *Accounts Head and Grouping*

   Firstly, the Group Masters has to be created followed by Accounts Masters. A new Account should have an Account Type. The Account Type as specified will govern the classification of the accounts for generating outputs. For example, if the account type is specified as expense, then it will appear in the Profit and Loss Statement and not in Balance Sheet. While grouping accounts, similar accounts should be grouped together, for example, all assets being clubbed under the group ‘Fixed Assets’. With groups, it is possible to manage accounts and take reports to any level of detail. The accounts sub-groups may exist within a group. Transactions cannot be entered in a Group. They can be entered only in Accounts.

2. *Entering Opening Balances*

   First time uses of the new mechanized system need to enter the opening balances and the master information. All the opening balances entered should be debited or credited in an Opening Balances Control Account exactly in reverse. That is, debit balances entered appear in the Opening Balances Control account as credits, and vice-versa.
3. **Entering Transactions**

Clicking on a ‘New Voucher’ button should give the next voucher number for the voucher series entered in. There should be provisions to enter the transactions any time and the system to arrange them date-wise.

4. **Double and Contra Entries**

All transactions involving contra entries should be entered only in one mode; and the second effect of the transaction should not be entered through another mode. For instance, cash withdrawn from bank should be entered either as a bank payment or as a cash receipt, but not both. Similarly, cash fee collection should be entered only through Students’ Module and not again as a cash receipt through this Module.

5. **Vouchers**

All expenditure transactions should be supported by documents. In the organization, one may create an office voucher for every transaction and attach the supporting documents as evidence. Every transaction entered should have a voucher number, auto generated serially by the system.

6. **Entering Journal Entries**

All accounting entries are basically journal entries where one or more accounts are debited and some others credited. But in this system, only those entries which cannot be entered through online transaction menus and special modes are specifically entered. Examples: to transfer an amount from one account to another; to pass adjustment entries; to pass year-end entries for depreciation; to transfer surplus or deficit to capital, etc.

7. **The Ledger**

The Ledger will be auto generated by an ‘exe.program’ present in the system. It will contain complete account-wise information of all transaction, arranged by date. It
should display the following details – Date of the transaction, Voucher No, Particulars, Amount entered- Debit/ Credit, Balance, and Remarks.

8. **Year End Process**

Transferring masters, account balances, etc from one year to another, that is, from one set of books to another is very important. For this purpose, it is needed to specify the target path and file name where the closing balances of the current year are to be transferred as opening balances along with all the master information. A new file should have been created with the specified filename and all the said information should automatically be posted.

9. **Reports**

Provisions must be there to export the external reports to different common file formats, including Word®, Excel®, HTML (Internet web page format) and others. Such external reports include the Final Accounts and the different Schedules to Accounts as referred earlier. In addition, the following reports are also to be generated for internal control purpose, such as Students’ Fee Collection Summary date-wise, Cash Payment Summary date-wise, Cheque Payment Summary date-wise, Cash Contra summary date-wise (including Petty Cash and Deposits to bank/s), Acquaintance Roll Summary month-wise, Library Fine Collection Summary month-wise, Security Deposit Schedule and Caution Money Deposit Schedule year-wise, Misc. Receipt Summary year-wise, and Misc. Payment Summary month-wise.

10. **Backup Files**

The system should provide a facility whereby the user can create back-up files of data. These files would have to be located in the path in which the data file is located and will have the same file name as the data file. The ‘bak’ file should automatically be updated with the latest data.
11. **The Network**

One computer should act as a Server. The Server can also act as a Client. All other nodes connected to the Server should act as clients. The operating system should be loaded on all computers. TCP/IP should be loaded/invoke on all computers. The ‘main .exe’ file should be loaded on the Server and on the nodes/clients. Data directories should be created the usual way by using the single user modules. The Server will manage all data in all the computers connected to the network. It is not necessary that the data be on the Server alone. All nodes, including the server should access data in all the computers at the same time. Thus, with the help of software on LAN, not only one can enter and process huge amounts of data from many nodes, one can even use the same directory/file, accessing them from different nodes at the same time. The reports should be updated to the last entry entered from any of the nodes, any time.

The above activities in the Finance & Accounts Section of a College may be represented by a DFD as shown in **Figure 4.11**.

**Fig. 4.11**: First level DFD showing the data flow of F,A & G Module

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The inputs entries in the transaction processing system may be summarized by the following diagram as shown in Figure 4.12.

The nature of transaction entries may be summarized below.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cash Receipt</strong></td>
<td>Fee Collection Book</td>
</tr>
<tr>
<td><strong>Cash Payment</strong></td>
<td>Cash payment Voucher, Salary Sheet Summary, Misc. Payment Register</td>
</tr>
<tr>
<td><strong>Cheque Receipt</strong></td>
<td>Cheque Receiving Register</td>
</tr>
<tr>
<td><strong>Cheque Payment</strong></td>
<td>Bank payment Vouchers, Salary Sheet Summary, Misc. Payment Register</td>
</tr>
<tr>
<td><strong>Contra</strong></td>
<td>Bank Deposit Slips, Petty Cash (Cash &amp; Bank Vouchers)</td>
</tr>
</tbody>
</table>

The Reports and Statements generated through the F,A & G Module may include routine documents as well as specific management information as shown in Figure 4.13.

The nature of transaction entries may be summarized below.

![Diagram showing the current transaction entries of the F,A & G Module](image1)

![Diagram showing the different M.I.S. Reports generated through the F,A & G Module](image2)
The inputs as mentioned above may be entered in the system through various interfaces spread in different parts of the system, may not be only through the F A & G Module (example, fees collection may be entered through Students’ Management Module). The inputs are to be stored in the distributed database in different tables. The data contained in such tables are then called to generate multiple reports. The output generation process in this Module is shown in **Figure 4.14.**

**Fig. 4.14** : DFD showing the information generation process form F A & G
The DFD as displayed in Fig. 4.14 represent the data flow of the related activities in ‘Finance Accounts and General Module’, which is a part of the transaction processing system of the individual institution, may it be a College or University. If we consider the ‘cluster institution’ situation, each of the individual institution will act as ‘client’ in the Client-Server Architecture, and all the data generated at the ‘client level’ must contain the institution’s identity code (viz. Inst_Code) at its prefix, auto punched with each and every transaction, to identify it’s origin in consolidated distributed database of the ‘cluster institutions’. For generating routine documents like Balance Sheet, Trial Balance, etc., executive programs may be inbuilt to generate such reports by fetching data from appropriate data fields and performing calculations through formulae. For non-routine documents, like Budget Schedule, Management Reports on sensitivity analysis and performance evaluation, etc., system administrator may use exclusively designed filter-tools and query language to generate such reports.

4.5.3 System Design of Students’ Administration Module

Rendering service to the students is the primary objective of any educational institution. To ensure good administration in this area, an organized administrative apparatus is needed, for which it is needed to mechanize some student-related activities that are of repetitive and clerical nature. To identify such activities, the student - institute relationship and the operational workflow are to be examined.

One Institute has many teaching, non-teaching staff and can admit many students. It has a fee structure for the service it renders to the students. This pay depends on the student’s class and course. The institute follows the course structure designed by the controlling organization, generally the University, and follow the specific admission
norms for granting admission to the students, based on merit list. On complying with the admission procedure the student gets admitted. The institute then takes initiative to assign unique identity number by way of the university rendered ‘registration certificate’ to the students after complying with the migration formalities (if any). For the evaluation of the progress of the student, the institute conducts internal examination/s and generate results. The students get their progress report by way of Progress Report Card or Mark Sheet. Moreover, a student may opt for transport facility (if available) and the hostel facility against additional fees. After each term-end, the institute arrange to send the name of the qualified students (who have passed the qualifying tests and attendance) to appear for the main University examination after examination-form fill-up activities. Finally the institute also take the initiative to collect the Mark-sheets and Certificates of the qualified students from the University’s Office and deliver the same to the individual student. In addition, the institute also take initiative to organize, manage and control some students’ programmes like seminar, NCC, NSS, Career Counseling, etc.. It also look after some annual events like Students’ Union Election, Annual Sports, Annual Function/Exhibition/Excursion trips. The Institute also need to send performance and status reports to its affiliating bodies, DPI, UGC and to government departments.

Based on the above-mentioned operational workflow, some activities can be identified to be included in the Students’ Administration Module that need mechanization.

1. On-line application, generation of merit list and admission management;
2. Students’ Register generation (stream-wise, class-wise and subject-wise) and generation of students’ identity card, distribution management of university registration certificate, mark-sheet, certificate, etc.;
3. Students’ performance tracking and reports generation through maintenance of Students’ Ledger and Faculty Ledger;
4. Collection of fees;
5. Class routine monitoring faculty-wise and class-wise;
6. Students’ attendance monitoring (class-wise and subject-wise) and reports generation;
7. Internal and external examination management and progress report generation;
8. Students’ feedback reports consolidation;
9. Record keeping and backup activities of other student programmes.

The activities identified above to be included in the Students’ Administration Module are the routine works, repetitive in nature and require less strategic human intervention in the work process. The module is conceptualized to cover all Institute-Student-Faculty related activities in a single system, and uses a common data format in a Management Information System (MIS) to generate reports across the system. The 'Student Subsystem' may provide the departments and central administration with information about students' election, registration, credits, degrees awarded and so on. The system is also expected to produce documents for students, departments and general administration for different purposes. A 'Teaching Subsystem' may be planned as a decentralized tool where data are fed in if the offices of the basic units around the campus and central administration uses this, for instance, for pay roll, making letters of appointment, reports to departments etc. A 'Premises Management Subsystem' may be planned to be used for the reservation and monitoring of teaching rooms and other common campus space showing the possibilities to change for certain purposes and also to differentiate between different sites, and their time of use. The departments may feed the annual work plan of each faculty member into a work-load subsystem built up on and linked with the basic subsystems. The Library Subsystem may also be
integrated with this Module to cover the information of library books clearance status, library fee clearance and caution money deposits of the students.

An overview of the data flow of these activities may be illustrated by way of a Context Diagram as shown in Figure 4.15.

Fig. 4.15: Context Diagram showing the overview of Student Administration Module
The admission, fee collection and class-examination management sub-modules are the most important areas where office automation is feasible.

A. Students’ Admission

The admission procedure, in general, follows the work flow as below.

1. The review of admission norms by the admission sub-committee;

2. Issue of application form. There is cash inflow through the selling of prospectus and form; which is accounted as cash receipt. Online admission in the cluster-institutions is the recent development;

3. Scrutiny of application forms, classification, verification with original documents, ranking of applicants on the basis of admission norms and granting permission for admission. If there is a need for a admission test, to conduct the test and publication of result rank-wise;

4. Cash Receipt on account of Admission Fee, Development Fee, Tuition Fee, Session Charge, Library Fee, Migration Fee, Sports Fee, etc. Some are one-time fees, while some are month-wise, eg. tuition fee;

5. Office copy of cash receipts are used to make entry in Students’ Admission Register, Students Register, and Students’ Fee Collection Register.

The computerization of the works involve:

1. Entries in Master database files:
   (a) Subject Master (with subject code and name)
   (b) Subject Combination (with Combination code, stream code, subject code, fee structure combination)
   (c) Fee Structure (with stream, category and combination)

2. Entries in Transaction database files:
   (a) Entry of Students’ details.
   (b) Entry of subject combination and class by which the admission fee is auto-calculated.
   (c) The primary entries saved in database after data verification and editing.
   (d) Printout of Money Receipts and Daily Collection Summary generated.
The inter-relationships of the various entities in the admission process is shown in Fig. 4.16.

**Fig. 4.16**: Context Diagram showing entity relationships in admission process

**B. Students’ Fee Collection**

The students’ fee collection is accounted for in the Finance, Accounts & General Module, but its management may be performed through the Students’ Administration Module. The works include Fee-Codes setup, Fees entry & correction, generation of reports on Daily Fee Collection, Head-wise Collection, Due Fee Report, Students’ Collection Summary, and Students’ Refund Summary. The workflow of these functions may be summarized by way of an algorithm as below:

1. **Entry of the master entries of the fee-code setup, i.e. FeeName, FeeClass, FeeAmount**;
2. **Entry of the roll number of a particular student**;
3. **Based on the FeeClass and the FeeType, the amount of fee will be generated showing the number of months and the total fee to be paid, and also the unadjusted fee**;
4. **Entry of the fee paid**;
   - If the FeePaid = TotalFee, Then
   - Adjustment of money under all heads for the given months,
   - Else
If FeePaid is not equal to TotalFee, then

Certain heads adjusted and the remaining to unadjusted fee.

5. Saving of the fee paid in the database;

The fee collection process may be illustrated by the help of Figure 4.17.

Input forms linked with database tables are used to conduct the work of students’ fee collection. The transaction entries are done through the entry of student’s id-code and transaction amount in GUI based Master Fee Code Setup Menu which call for all relevant information from previously entered master database tables automatically. Inputs entered through this sub-module perform the validation and correction adjustments (if any) and is stored in the distributed database to be fetched by the F A & G Module to prepare Fee Collection Schedules and Income Statements. Thus the inputs entered in one Module may be shared and utilized by other Modules, provided the system contain the validation checks and controls of not granting permission to enter the same data twice in the system, but to fetch it from the database. Provisions must be there to make correction entries, which must include particulars of adjustment voucher references and adjustment amounts.
The major reports related with students’ fee collection may include:

………… Daily Collection Statement
………… Monthly Collection Summary
………… Yearly Collection Summary
………… Students’ Fee Collection Ledger
………… Defaulters’ List
………… Fee Payment Status (On Ledger)
………… List of Transferred/ Cancelled Students
………… Payment Status (on Ledger)
………… Fee Pay Structure Subject/combination-wise
………… Daily Fee Collection
………… Payment Report- Individual Student

C. Students’ Examination

Scheduling of classes as per routine, internal and external examinations, publication of results of the internal tests, generation of progress report and tabulating the result of the external (university) examinations are some of the major works in this sub-module. The general work process involved in the supervision of the external examinations include:

i) Performa send to the University mentioning the name of the students going to appear for the university examination during the session, their registration number, language and combination taken.

ii) Printed performa send by the university for checking, which are to be returned by the institution after entering necessary corrections.

iii) University send Application Form, to be filled up by the students intending to appear for the external examination.

iv) Admit Card issued by the University. The information entered in the Admit Card Register maintained by the College, and then the Admit Cards are distributed to the students.

v) After the publication of the results of University Examination, the performance of the outgoing students entered in the University Marks Register.
The works involved in the supervision of the internal examinations are:

i) Allocation of duty regarding paper setting, evaluation of answer-scripts, and preparation of duty roster for invigilation works.

ii) Compilation of attendance record of students.

iii) Tabulation of marks subject-wise, stream-wise, roll-number-wise and the generation of promotion list.

iv) Verification of fee payment position of the promoted students, and collection of fees of the new session / outstanding fees of previous session/s.

Analyzing the work process, it can be observed that there are laborious repetitive works in the process, which may be re-scheduled in cluster-institutional environment as shown in the Figure 4.18.

Fig. 4.18: DFD showing information management of internal students through Examination Monitoring Module

4.5.4 System Design of Library Management Module

Amongst the sub-modules of Acquisition, Cataloguing, Circulation, General Administration, Query, Membership and Online Public Access Cataloguing that are commonly found in a full fledged Library Automation Systems, we consider only the functions that generate management information for the integrated Uniform Office Management System of cluster based institutions, which define the scope of research in this area. The output requirements are:
(i) Information of library clearance status of the students

(ii) Library caution money deposit & refund status

(iii) Online public access cataloguing search management of books and journals (title-wise, subject-wise and author-wise)

(iv) Paid services (eg, photocopy services, etc.) – accounting and management

It is expected that uniform library automation software is installed in every institution of the cluster which should be user friendly and work under client-server environment through GUI based web browsers. It may be linked with the Information and Library Network Center of UGC (INFLIBNET). While designing the software, the international standard, bibliographic formats, networking protocols, and typical function of all types and sizes of libraries particularly at university and college level, are to be taken into account. To the users, it may provide user services like query on holdings (books and journals), new arrivals and user status (issue and return of books/journals). To the front office library staff, it may provide front office services (issue and return of books to valid users). To the acquisition staff, it may provide acquisition services like cataloguing new books and journals with appropriate information. To the Librarian, it may provide administrative services for monitoring the overall system. Optionally, other services like backup and restore operations may be performed by it.

In most of the College and University Libraries, the work process is more or less the same. The users may need to conduct a catalogue search (may be online) and enquire the status of library holdings; the library staff may need the service of the software in automating routine functions like issue and return of books/journals and to keep the library catalogue up-to-date. The library users, that is the students and the teaching
staff would expect to query the library holdings in a friendly and flexible manner, using any information that is complete or partial (full title, part title); specific or fuzzy information (accession number or subject area). The queries, in general, would include the following: search books / journals by author, title, accession number, search books by subject, check issue status of a specific book, check status of books issued to an individual, check arrival and issue status of specific journal, view results on the screen, and print output of search results. There must be a mechanism for collection of overdue penalty from users who do not return books.

Library automation through a menu driven program package is the solution to the output requirements. A detailed list of menus and sub-menus that help control the various functions is presented in Section 4.4.2.

A context diagram is presented below that specifies the basic functionality of the library automation package, as shown in Figure 4.19.

![Context Diagram](image)

**Fig. 4.19**: Context Diagram showing the overview of Library Management System

The various processes in the Library Management System are identified as the Issue Process, Return process and the Query process. The data flow of these processes is illustrated by the following DFD as shown in Figure 4.20.
In Library Management System, the major data files relate to holdings (books and journals) and users. The major process, i.e. ‘Query process’ operates on the holdings and user database. The other major process ‘Issue & Return Process’ operates on holdings and user database to create the ‘Issues’ database file. This is a transaction file whose status continuously changes as the books and journals are issued and returned. Being the major transaction type database file, there must be regular back-ups, so that in case of any file corruption or data loss, the system can be restored back to the normal status. In cluster environment, the resources of the Library and Information Centre of each member institution may be shared by the student and faculty members, may be on inter-institutional M.O.U. arrangements or individually against service charge against each transaction. In such case, each local resource center may act as profit center. The heart of the activities in such center is query

**Fig. 4.20 : First level DFD showing overall data flow in Library Management System**
processing and servicing. A pseudo code of such a query process is presented as below:

1. Decide the type of query by user interaction (user, book or journal)
2. If User Query, then
   Get User-Id
   Retrieve info and display
   Loop if necessary (for more queries)
3. If Book / Journal-Query, then
   Get Book / Journal-Id
   Retrieve information and display
   Loop if necessary

(Queries may also be made by author, subject and book-title).

4.6 Design of Management Information Module

A separate arrangement may be kept in the Uniform Mechanized Office Administration System through user friendly menu driven program package, for warehousing and data mining works of the documents and reports generated through all the functional modules. The objective for such a separate menu-module is to help the users to find the information that they most commonly use for management information and correspondence purpose. It may be visualized as a directory (named DATAMIS) where reports in the form of documents, spread-sheets, and database indexed files are kept in sub-directories through auto generated backups of generated reports from different functional modules of the institute /college, navigate able through a search index. Provisions may be there to open embedded ‘Word’ or ‘Excel’ compiler and export data into them from source database files.

The following file arrangements may explain the structure of the MIS module as presented in Figure 4.21.
The “DlgMIS” form may be designed to create a new document (DlgNewMIS) from the existing designs as present in DATAMIS sub-directory of MIS, and save it as “DOC(1)” in the self created sub-directory ‘DataMIS’. DlgOpenMIS may be used to open an existing report that are saved as backup files of the database files generated in any of the four functional modules. Such files may be exported to spreadsheets, more than one file may be merged or combined, to regenerate new MIS documents. Routine files (like payslips, etc.) may be opened from the classified sub-directories and printouts may be taken directly. Those sub-directories may be storehouse of Daily Reports, Weekly Reports, Monthly Reports, Yearly Reports and Special Reports. The ‘Create On’ buttons may be used to open the application compilers (Word and Excel) and work within it while staying in the system. The design of a GUI interface of MIS Module using Visual Basic may appear as illustrated in Figure 4.22.

![Fig. 4.21 : Structure Chart showing warehousing scheme of MIS Document](image)

![Fig. 4.22 : GUI interface design of M.I.S. Module](image)
The algorithm of the work process may be described below.

**Step 1**: Input the Type of the work.

**Step 2**: If Type = OpenDocument, then goto Step 7  
Else goto Step 3

**Step 3**: If Type = NewDocument, then goto Step 8  
Else goto Step 4

**Step 4**: If Type = open WORD application, then goto Step 9  
Else goto Step 5

**Step 5**: If Type = open EXCEL application, then goto Step 10  
Else goto Step 6

**Step 6**: If Type = OpenFileFrom “StudentModule/ StudentModule/ FA&Gmodule/ LibraryModule”, then open respective sub-folder, goto Step 11  
Else goto Step 7

**Step 7**: Open existing document from any of the Module, edit it, save it, goto Step 12

**Step 8**: Create new document format from an existing format as present in parent directory, edit and save with a new file-name, goto Step 12

**Step 8.1**: Create new Word processing document, save it in a directory of user’s choice, goto Step 12

**Step 8.2**: Create new Spreadsheet document, save it in a directory of user’s choice, goto Step 12

**Step 8.3**: Open exported DBMS Report Document in spreadsheet format’, edit it, save it, goto Step 12

**Step 9**: Open WORD application through Object Linking & Embedding, goto step 8.1

**Step 10**: Open EXCEL application through Object Linking & Embedding, goto Step 8.2

**Step 11**: Open DBMS application through Object Linking & Embedding, goto Step 8.3

**Step 12**: End.

The MIS Module may generate both routine MIS documents and non-routine exclusive special purpose MIS documents. The routine MIS documents may again be classified as (a) that need no editing (eg. Pay-Slip, DPI Pay Abstract, Form 16, etc.); and (b) that need editing, through adding or deleting some details as per the prescribed proforma of DPI/ UGC/ University/ Other Bodies. The reports that need
no editing may be stored in the MIS sub-directory under its source module, and printouts may be done directly. For special purpose MIS documents that need merger of multi-natured information from more than one file stored in the database, the extracts of the select database reports may first be exported into spreadsheet formats, to be then combined through formulae and functions to generate ‘just as required’ reports.

4.7 Systems Security

Information has now come to be treated at par with other vital resources by most organizations. Inadvertent or malicious loss, misuse or destruction of data can lead to consequences as disastrous as loss of men, material or money. The hazards that could disable the computer operations may be hardware and software failure, environmental failures involving power supply, building integrity, etc., sabotage, operational errors, unauthorized access, computer viruses and so on.

The best ways in ensuring data security is to create an awareness for data security through the understanding of ways in which information can be manipulated and the would-be consequences of such occurrence, and to develop a culture within the institution to control it. Planning the levels of protection for various aspects of information relating to the institution and information classification; selection of technology, keeping in mind obsolescence due to new innovations and necessity for keeping pace with it; physical protection of machine and media; identifying responsibility centers for security levels; and controlling and monitoring the access to data through provisions for log-in/out and password are also the relevant considerations in data security issues.
Institutional system may provide various mechanisms to prevent access to data to unauthorized persons. ‘Super-User’ and ‘User’ classes may be defined. Users may be given only ‘Query view’ or some ‘Modular Transaction view’ of the data so that he/she can have only ‘read’ or ‘data-entry’ access to a limited amount of data. An illustrative model, highlighting these features, may be presented in Figure 4.23 below.

![Diagram](image)

**Fig. 4.23** : DFD showing the workflow of the security system in cluster-institutions

When the system starts-on, only the Monitor-User and Utilities are to be kept enabled, while the others (viz. Staff Administration, Student Administration, Library Management, F &A, Management Information) are to remain inactive. The super user (who may be the Systems Manager) is to give accessibility of the other remaining menus to the different users. When the ‘Super User’ submenu is selected, a new
window need to open which would want the name and password of the super-user. After it is correctly typed in, the system should first check from the super-user database, whether that name and password is valid. If it is not, the system should again ask for the correct name and password. When it is valid, the system would open a new window from where the super user can enable the remaining menus. A facility must be there to enter new names and their passwords, which should automatically be updated. Lastly, the super-user has to click on a ‘OK’ button for confirmation. The screenshots as shown below depict the working of the proposed security system.

Screenshot 4.1 show an opening menu from where the users may enter their own operating modules as specified by the super-user before-hand. The super-user will have his own password that can be altered at his discretion. The other users should also have their separate passwords, but only after it been assigned by the super-user. The super-user may allow his users even a partial access to the module. This activity
may be performed through his selecting the appropriate ‘checkbox’ as depicted in Screenshot 4.2.

Screenshot 4.2 as shown above depicts the main control menu of the super-user. The check boxes as shown in the diagram may provide the tool to be used by the Super-user to allow others to get access to the submenus and into their parts. As soon as the subs of the sub-menu (here in this illustration, the ‘Payroll’) are ticked in the check boxes, those subs get activated to be used by the operator who would have the access to the submenu (here Payroll). This is illustrated in Screenshot 4.3.
It must be noted that the passwords as assigned by the Super-User must be stored in a database, which should automatically be updated when some new name or password is given by the Super-User. This is illustrated in *Screenshot 4.4*.

The Password Validation Logic may be shown below.

```vbnet
Private Sub Command1_Click()
y1 = Text1.Text
y2 = Text2.Text
str1 = "user_name=" & Text1.Text
str2 = "password" & Text2.Text
y3 = Data1.Recordset.Fields("user_name").Value
y4 = Data1.Recordset.Fields("password").Value
If y1 = y3 And y2 = y4 Then
MsgBox "Welcome super user"
Form2.Show
Text1.Text = ""
Text2.Text = ""
Else
MsgBox "Try again"
Text1.Text = ""
Text2.Text = ""
Form2.Hide
End If
End Sub
```