# Information Systems in Higher Educational Institutions

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*Abstract*— Nowadays higher education has been a prime need for all for a better future. As the higher education is globally expanded to a great extend, anybody can attain this from anywhere. But still, the educational institutions have to play a big role to provide the students all the necessary resources on time for them to make their education a quality one. In such a situation, it has been proved that information systems can do wonders. This paper is intended to show how to help an institution in storing, analyzing, monitoring and improving all the academic and co-academic information and status in an efficient way. The major pillars of an education system are the students, their parents, teachers and the management. They are the ones who can point out the actual needs related with an educational institution. If there is an efficient information system that can assist an institution in identifying and evaluating the needs and corresponding solutions, the management will be able to easily get adapted to the new global changes.

*Keywords*— Quality, Information System, Cloud Data Storage, Real-time Data Processing, Intelligent Information Analysis, Results-based Performance Monitoring

## I. INTRODUCTION

The aim of education is always developing prominent human resources for the globe. The institution must provide various features including self-evaluation and self-assessment opportunities that facilitate the education system to ensure quality. With the aid of information systems, the institutions can have a routine improvement regardless of curricular activities carried out as usual.

The keywords Quality and Information System may be defined as follows:

*Quality:* Quality of education depends on quality of learners, learning environment, learning content, process and outcomes (UNICEF)

*Information System:* Information System is an academic study of systems with a specific reference to information and the complementary networks of hardware and software that people and organizations use to collect, filter, process, create and also distribute data [1].

An information system is composed of following major components [2]:

1. *Hardware*: The physical parts or components of a computer.
2. *Software*: Includes the operating system and all the utilities that enable the computer to function.
3. *Data*: Values given to a computer for processing.
4. *Procedures*: Policies that control the process of a computer system.
5. *People*: The major component of information system who is going to use the computer.
6. *Feedback*: Information about processes carried out by the computer.

Architecture for an Information System used by a typical organization is having four levels representing workers, middle managers, senior managers and executives, where each level encompasses its own responsibilities to make it an effective system. This four-layered architecture is expressed in the following figure [2].
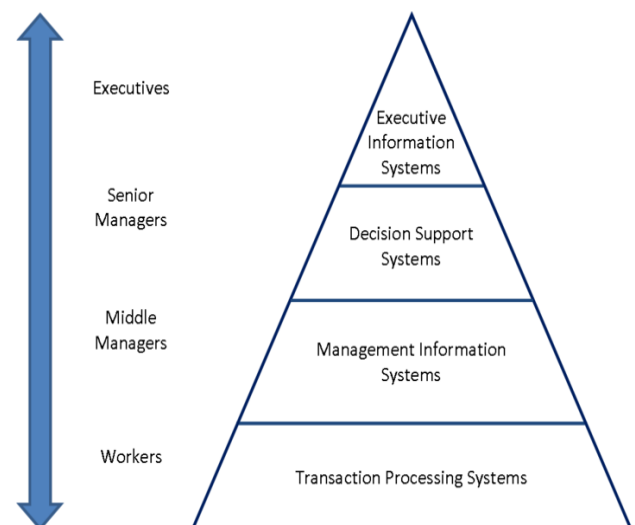


Figure1. Information System Architecture

1. *Transaction Processing Systems*: used by employees in the organization.
2. *Management Information Systems*: used by middle managers that help managing the organizational activities.
3. *Decision Support Systems*: used by senior managers to take appropriate decisions for the proper functioning of the organization.
4. *Executive Information Systems*: used by organization executives.

In the following sections, the paper gives an insight into an introduction to information systems in higher educational institutions, need for and activities carried out in such a system.

## II.    OBJECTIVE OF THE STUDY

A highly capable information system can make an institution easier to handle its activities and responsibilities. An information system can be made to successfully collect and manage the necessary information thereby providing facility to constantly monitor the improvement in the institution's held position. Manual processing of entire information in an institution can be automated by gaining the advantages of utilizing time and efforts. It can also create indicators that can manage the distribution and allocation of educational resources and services which are explained later on. Thus the major benefit of information system lies in the concept of handling the physical information electronically undertaking digital technologies.

An educational information system may be considered with the following modules:

1. *Administrator*: Principal or an in-charge who will control the information system activities.
2. *Teaching Faculty*: Assigned faculty members will collect and store the data regarding teaching aids, infrastructure facilities and students' assessment information. He/she will also be responsible for a successful feedback system with students and parents.
3. *Student*: Each student can retrieve his assessment report and can self-evaluate his performance. He/she will get provision to present the modifications needed with the current education system.
4. *Parent*: Parents will be having provisions for consistent communication with respective faculty members and for retrieving the assessment reports of their children. He/she will also get provision to present the modifications needed with the current education system as well as mentoring system.

## III.    ACTIVITIES IN A HIGHER EDUCATIONAL INFORMATION SYSTEM

A Higher Educational Information system can be viewed with the following collection of ordered activities:

1. *Data Storage*
2. *Data Processing*
3. *Information Analysis*
4. *Performance Monitoring*
5. *Resources Identification*
6. *Education System Improvement*

*Data Storage:* This activity collects and stores all relevant data by the particular users of the information system. For reliable data storage, online data storage methods can be considered, such as Data Warehouse, Data Marts, and Data in the Cloud etc. These methods can store large amounts of data like our need.
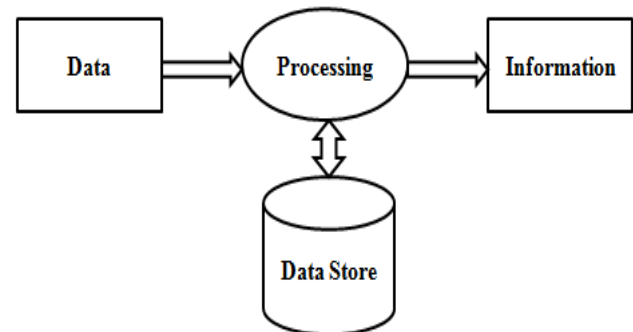


Figure3. Data Storage and Processing Activities

*Data Processing:* During this activity, the stored data is processed to convert into relevant information set and organize it in a useful mode. This may involve validations, summarizations etc.

*Information Analysis:* Using statistical data analysis methods, this activity can aggregate the information, perform necessary calculations, interpret, evaluate and generate reports. The analysis methods may involve proportions/percentages, ratios, scoring/ranking etc. depending on our purpose [3].
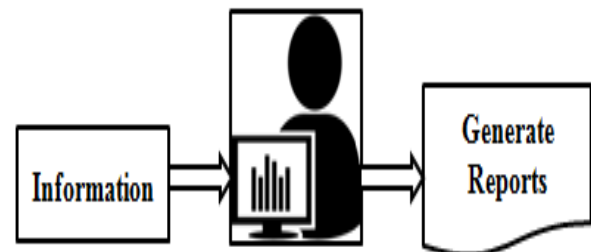


Figure4. Information Analysis Activity

*Performance Monitoring:* By verifying the generated reports, this activity can show the performance level of institution parameters such as infrastructure facilities, students' score etc. so that the progress level can be identified easily.

*Resources Identification:* During this activity, all the factors and resources affecting the education system can be identified by retrieving the progress level of the institution parameters. For this, an active decision support system of the institution can assist well.

*Education System Improvement:* By identifying the resources further required or to be modified can be integrated into the existing institution in order to get an improved status.

Any institution with facilities of online data storage and access can implement an information system easily. The flow of activities can be represented diagrammatically as follows:
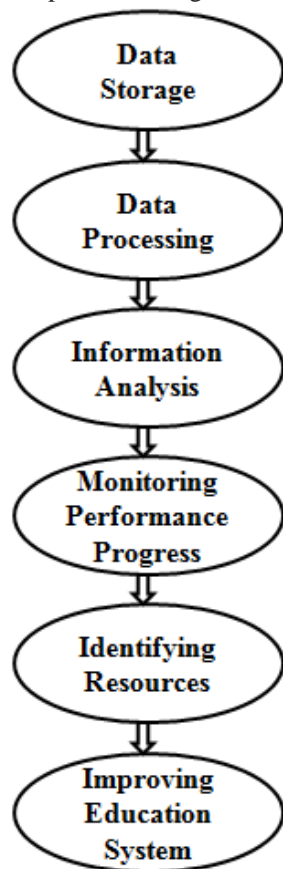


Figure2. Activities in an Educational Information System

These activities can be employed in the proposed system in the following manner.

### A. Cloud Data Storage

A Higher Educational Institution (HEI) needs unlimited data storage due to its ever growing nature. For unlimited and online level of data storage, Cloud storage is the ideal option. Cloud storage is the virtualized storage on demand which is hosted remotely using online data storage devices and maintained by internet service provider [4]. With cloud storage we can access application software, application platforms and application infrastructure easily as a service.

The major characteristics which make it suitable for HEIs are pay-as-you-use nature, flexibility, simplicity and accessibility. This can facilitate better teaching and learning methodologies also by providing following features:

- Improved productivity
- Reduced expenses
- Collaborated work support
- Information backup and recovery
- 24x7 information access
- Improved data security

A number of cloud-based applications are available for accessing the cloud services. Most widely used applications include Hadoop, Yarn and Tez. Hadoop is a distributed open-source software framework. Yarn is a resource management system providing processing resources. Tez is an extensible framework for building Yarn-based applications in Hadoop [5].

The proposed system can also ensure security of data stored by employing database level encryption by which authorized users can only access the data for processing.

### B. Real-time Data Processing

All the necessary data collected will be stored in databases which can be accessed easily. The data may include text as well as multimedia which can be handled easily by the databases. By processing these data properly, well organized information should be produced. For this purpose the proposed system make use of online and Real-time data processing methods.

In Real-time processing, data entry and information retrieval happens at the same time. That means, as and when the data is entered, it will be stored, processed and will get updated instantly [6]. The user will be accessing the updated data each time without any delay.

### C. Intelligent Data Analysis

The proposed system mainly deals with information related to the institution's internal and external activities and infrastructure. In order to analyse the present status of the institution, ordinary set of prescribed statistical tools are not enough. For this purpose, the proposed system can employ intelligent technologies based on iIT (Intelligent Information Technology) which is getting advanced each second.

Intelligent data analysis involves careful evaluation, thorough examination, testing and assessment [7]. For producing a view on the processing and analysis of data, on-time report generation is the essential one. Large number of automated documentation engines is available for ideal report generation either in document or in the web page format. These engines can also create charts and virtual documents along with template documents. The proposed system can easily make use of any of such engines for effectiveness.

### D. Result-based Performance Monitoring

Intelligent analysis can result in stating the current status of the institution's performances. By identifying the current status, the proposed system can compare it with prior status of the institution by using results-based performance monitoring and evaluation methods. By conducting continuous tracking of the change in progress and depicting it using charts, the system can easily identify the progress of the Institution. The major phases of this activity are Monitoring and Evaluation [8].

Monitoring phase begins with setting up of the program objectives. Then the activities and resources are linked to the objectives which are then converted to performance indicators in order to set targets. Performance indicators indicate the current status of the program which is compared with the targets to get the progress reports that may be passed to the high level management.

If the institution couldn't meet with the objectives, the evaluation phase is activated wherein it is analysed why the respective results were not achieved. Now the causes may be assessed and suggestions may be made on the implementation. The institution management can provide an awareness session for the members on how to improve the current status.

### E. Identifying Resources

During monitoring phase, the management can identify in which areas the institution has more requirements to improve the performance. Sometimes, the institution may be undergoing with lack of certain resources. The resources required for an institution may include human resources, financial resources, educational resources or at times emotional resources. Apart from these, an institution may suffer from shortages of external resources such as water and energy, certain products and supplies etc.

These deficiencies can be easily identified by the proposed system, as it provides the facility to express the requirements directly by the students, parents and teachers which are recorded in databases properly on time [9]. Now, the mangement can prioritize the requirements by the support of a strong decision-making team.

### F. Improving Education System

This activity is simply satisying the high priority resource requirements which will automatically improve the institution's status. The proposed system can keep track of the changes made with the present status and can submit a detailed report to the management.

### IV. CONCLUSION AND FUTURE SCOPE

Quality of education depends not only on a set of traditional books and papers, but also on quality of teaching, infrastructure facilities and highly on the motivation level of the students. A continuous process is necessary to evaluate and identify the required resources and parameters that can make the education system fruitful. This paper lightens to the need for information system in higher educational institutions for consistent monitoring and improvement of the education system.

In the proposed system, the major activities carried out make use of cloud storage mechanisms. In future as more intelligent data storage mechanisms get into practical, the system can easily be incorporated with such mechanisms which may ease those activities quite a bit more.

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