



INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X

Impact factor: 4.295

(Volume 5, Issue 3)

Available online at: www.ijariit.com

Designing and implementing result reporting tool using OLAP technology

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ABSTRACT

A large amount of data is generated in educational institutes. The produced data does not provide a clear picture due to which the important details might not be visible. This data can be used in different ways if it is analyzed properly. Analysis of data plays an important role in the understanding of information. The main objective of this paper is to develop a web-based software which evaluates the performance of students, faculty, and departments and predict the placement of students which will eventually help in evaluating student's potential strengths and weaknesses for the growth of the institutes. As data sets have grown in size and has become more complex, therefore this has made the efficiency of data mining algorithms to decrease. So OLAP technology is used in this paper to analyze database information from multiple databases at one time and its data is stored in the multidimensional database.

Keywords— OLAP, Analysis, Performance, Dashboards, Data mining

1. INTRODUCTION

As we know, an educational institute contains a large amount of data, maintenance of which is quite difficult. Due to this the available information is neither reliable nor consistent and is difficult for the institute to interpret their progress [3]. This happens due to varying data formats or improper data updating. Universities hold their data in the less or in operational databases where data is neither safe nor used for decision making purpose. Keeping this in mind we are designing a web-based application to make it easy for the institute to check its performance and hence take important decisions which will contribute to the progress of the institute. So, in this application, performance evaluation of students, teachers and department as a whole will be done using OLAP Technique.

OLAP allows users to analyze database information from multiple databases at one time. OLAP supports queries about multi-dimensional, multi-level aggregates and summarization of data at various granularities to identify trends, exception and interesting regions [6]. Therefore, OLAP technology is used in this paper to get the result easily and quickly using multiple attributes.

These calculations will be helpful for the institute to know the number of students failed or passed in a particular subject, the average score of each student and the average score of all the students, etc. These will also help in improving teaching techniques. This system also identifies relevant attributes based on quantitative and qualitative aspects of a student's score such as CGPA, academic performance, technical and communication skills which can predict the placement of a student. The result of this analysis will assist the academic planners to design a strategy to improve the performance of students that will help them in getting placed at the earliest. [7] Thus, our system will help in the overall progress of the educational institute.

2. RELATED WORK

[1] Analysis of Students Performance Evaluation Using Classification Techniques - V. Shanmugarajeshwari, R. Lawrence IEEE-(2016). The aim of this paper is to help the learners as well as teachers to evaluate academic performance. In this system, the student's data are collected from the survey and pre-processing of data is done. Student's performance has been predicted using decision tree classification methods. Missing values were removed and categorised. Feature selection technique is applied on pre-processed data to select the relevant attributes. The classic student's results are obtained. This way performance analysis is done.

[4] Analysis of Faculty Using Data Mining Techniques- Chandrani Singh, Arpita Gopal IEEE (2015). The aim is to predict the quality, productivity and potential of faculty across various disciplines. The analysis depends on many factors such as encompassing student's feedback, organisational feedback, institutional financial support, administration, etc. To evaluate faculty performance, PASW statistics was used to classify the data using the K-means algorithm to generate the clusters. The statistical le was then subjected to rigorous analysis using classification and regression tree algorithm. Proposed technique justifies the use of data mining to provide effective monitoring tools for faculty performance.

[4] Performance Analysis and Prediction in Educational Data Mining: A Research Travelogue - Pooja Thakar, Anil Mehta, Manisha IEEE (2015). The objective of this paper is to identify the factors for the low performance of students and predict their behaviour. Students will be able to identify their weaknesses beforehand and improve themselves. Teachers will be able to plan their lectures as per the need of students and can provide better guidance to such students.

[3] Results and Placements Analysis and Prediction Using Data Mining and Dashboard - Siddhi Parekh, Ankit Parekh, Ameya Nadkarni, Riya Mehta IEEE-2016 The main objective of this system is to generate query specific reports of the academic performance of a group of students which helps on evaluating students potential strengths and weakness with respect to requirements of various companies for placements which assists in understanding placement trends. In the proposed project, the software will generate a summary report regarding student information. Prediction module of the system uses a classification technique to predict the future trends and placements of students based on various parameters. The classification model is run on a selected set of data. The system aims to provide an efficient single point management system which will give all the data of the students of the college at the same place.

3. EXISTING SYSTEM

In the present scenario, there is endless competition amongst students and institutes. So, there is a need to be more organized and have the ability to make correct decisions and make appropriate changes [3].

Problems associated with the existing systems:

- (a) Even after the collection of data from different departments, the data format may be non-uniform and will require structuring [3].
- (b) The data is maintained in different departments in distributed locations [3].
- (c) When the consolidated report from two or more different attributes is required, it is almost impossible [3].
- (d) Management and it difficult to locate the reports needed by them as the data is in the segregated form [3].
- (e) Excel reports cannot be used by multiple users at the same time [3].
- (f) Controlling data access and restrictions on spreadsheets can be difficult when there are hundreds of spreadsheets to manage and a number of users requiring access [3].
- (g) Excel is incapable of supporting quick decision making and time-consuming [3].
- (h) All the existing systems are presently using a data mining algorithm for performance evaluation of the students or the whole educational institute.

4. PROPOSED SYSTEM

By considering the above the problems with non-consistent data formats and slow data access, we aim to build a web-based system for the analysis of the students' academic performance, whole departments' performance and prediction of placement results of the institute. It is an online application that can be accessed by student, faculty and admin. It helps to manage the student's information like their marks in various semesters, subjects and admission information and faculty's information. OLAP technology is being used in this application that helps to retrieve data quickly and speed up the result preparation and data management process. It performs analysis of stored data to provide answers to the questions.

5. SYSTEM DESCRIPTION

The proposed system is user-friendly web-based application developed for educational institutes that uses a single centralized integrated database for storing all information in the database regarding students like their marks in various semesters, subjects and admission information and faculties' information. All the information is not accessible to every user. Students can access only their information and check their performance. Faculty can access all the students' information and their performance. It creates query specific reports according to user requests which can be observed in a visually enhanced manner using bar graphs for better understanding of the information displayed. This systems module evaluates the student's ability and potential using and relating various parameters such as academic performance, extra-curricular activities and provides with suggestions on improving the quality of students helping the institute to take a decision on replacing or modifying their teaching patterns and admission policies. This system module also predicts if the student will be placed or not based on certain attributes like CGPA, Programming Skills, Xth and XIIth mark, Communication Skills, Backlogs (alive or dead) and Internships. This will help the students to improve their weak skills so that they don't face any problem during their placements and thus will help in their overall improvement. Following are the features of our system:

- (a) A number of students failed or passed in one subject.
- (b) An overall score of each student.
- (c) The average score of passed or failed students.
- (d) Participation of each student in extra-curricular activities.
- (e) Whole department performance on the basis of the average score of students.
- (f) The average score of each subject on the basis of students score in that subject.
- (g) Entire college performance on the basis of students score.
- (h) Prediction of which course is currently in demand
- (i) Upload previous year's project reports for the reference of current students.
- (j) Prediction of placement of students.

6. SYSTEM MODULES

6.1 Log in page

Every user will enter the user name and password for authentication and security purpose. Hence, maintaining the integrity and availability of information.

6.2 Dashboard

Dashboards contain three options which are Student, Faculty and Department. The user has to select branch and semester and then click on the given button for checking the performance in graphical format using bar charts. Accordingly, students can access their information and can check their performance. Similarly, faculty can access their information and

check students' performance. This software will generate summary report of student information, faculty information and performance report, which can be visually enhanced for better understanding, helping in academic results for decision making based on student's results and extra-curricular activities to improve their academic performance.

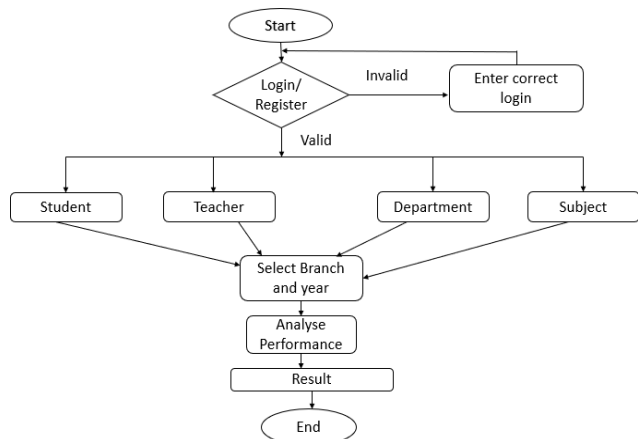


Fig. 1: Flow diagram

6.3 OLAP (Online Analytical Processing)

OLAP is a computing method that enables users to easily and selectively extract and query data in order to analyze it from different points of view [9]. OLAP allows users to analyze database information from multiple database systems at one time and its data is stored in a multi-dimensional database. OLAP data is multi-dimensional, meaning the information can be compared in many different ways. OLAP tools also allow a breakdown structure of the data where you start with the single piece of data and you dissect it into a series of levels looking at the data for something interesting [11]. The need for evaluation of the performance in a high institution is very important. This will help to know when to change the track, make a slight change in the method of approach of learning [11]. Three types of analytical operations in OLAP are:

- (a) Roll-up[11]
- (b) Drill-down[11]
- (c) Slice[11]
- (d) Dice[11]

6.3.1 Roll-up [11]: Roll-up means aggregation. The Roll-up operation can be performed in 2 ways:

Reducing dimensions
Climbing up the hierarchy. It is a system of grouping things based on their order or level [11].

6.3.2 Drill-down [11]: In drill-down data is fragmented into smaller parts. It is the opposite of the rollup process. It can be done via Moving down the concept hierarchy and increasing a dimension [11].

6.3.3 Slice [11]: Here, one dimension is selected, and a new sub-cube is created [11].

6.3.4 Dice [11]: This operation is similar to a slice. The difference in dice is you select two or more dimensions that result in the creation of a sub-cube [11].

6.4 Star Schema [7]

The star schema is the simplest model used in DWH. Because the fact table is in the center of the schema with dimension tables around it, it looks roughly like a star. This is especially apparent when the fact table is surrounded by five dimension

tables. A variant of the star schema the centipede schema, where the fact table is surrounded by a large number of small dimension tables.

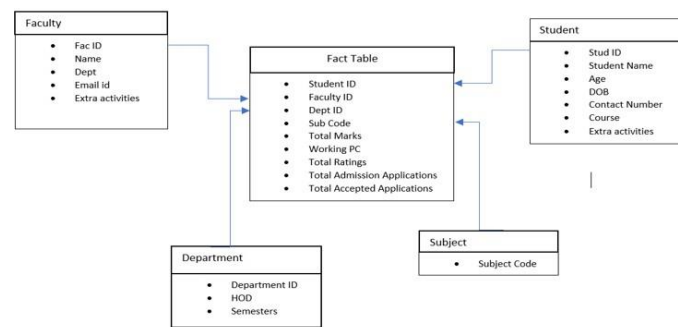


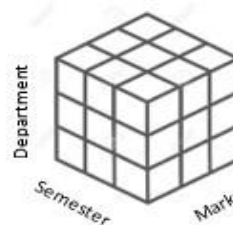
Fig. 2: Star Schema

In the given Star Schema, there is one fact table which will include the primary keys of dimension tables that is faculty, department, subject and student. It works in the following way. For example, if we want to know a particular department's performance then we will extract the department-id attribute and give the appropriate condition (name of the department) and retrieve total marks from the fact table which will give overall marks of all the academic years. Similarly, other information of performance analysis can be retrieved using star schema.

7. METHODOLOGY

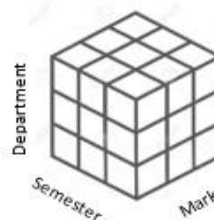
In the proposed system, the OLAP technique is used for data retrieving and to represent data in a better way. In OLAP technique, there are four analytical operations which are Rollup, Drill-Down, Slice, and Dice.

- (a) **Roll-Up:** In this operation, we have considered the dimensions as department, semester and marks. This is used to get the overall academic performance (grouping) of the department.
- (b) **Drill-Down:** It is the opposite of roll-up. It gives detailed information about every student in a class (basically accessed by teachers).
- (c) **Slicing:** It is used to get the information of a particular student or a teacher.
- (d) **Dicing:** It is used if a teacher teaches the same subject to more than one class and if he/she wants to compare the results of those classes.



Ex. CST-> Sem 1,2,3,4->Overall %

Fig. 3: Roll-up operation

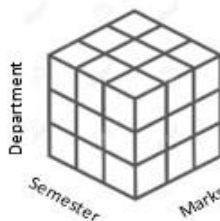


Ex. CST-> Sem 1->one student->Subject->Marks

Fig. 4: Drill-down operation

8. IMPLEMENTATION

It is a web-based application developed for educational institutes that uses a single centralized integrated database for storing all information regarding students and other college activities like training and placements. All the information available in the storage is not made accessible to every user. Each user will be provided with a user name and password for authentication and restricted access and rights to information to protect the integrity and availability of information. It creates query specific reports according to user requests which can be observed in a visually enhanced manner using bar graphs on the dashboard for better understanding of the information displayed. The source data had to be analysed depending on their usefulness for analysis and extracted for OLAP processing. The OLAP system was responsible for transforming the input data into OLAP cubes.



Ex. One teacher->BDA->Comparison of two classes

Fig. 5: Dicing operation

The OLAP package will create a new database suitable for multidimensional analysis and query rather than two dimensional, relational query. It will prepare the data in order to be readily available for all possible analysis scenarios and feed the reporting software module with respective reports.

In an educational institution the overall performance of the student is determined by their academic score and extra-curricular activities. Extra-curricular activities are made on the basis of programming skills, Technical paper presentation, sports, project competition, hardware workshops, software workshops, council participation.

8.1 Tools and technologies

The tools and technologies used in the project are as follows:
 Language: HTML, CSS, SQL Text Editor: Sublime Text 3
 Databases: MySQL
 Web Server: Apache GUI: phpMyAdmin

9. RESULTS

9.1 Subject wise Performance

In subject wise performance, we can understand the overall score of each subject and accordingly prediction can be done on which subjects teaching needs to improve. Here x-axis denotes the number of students and y-axis denotes subject's name. This shows the number of students passed or failed in one subject.

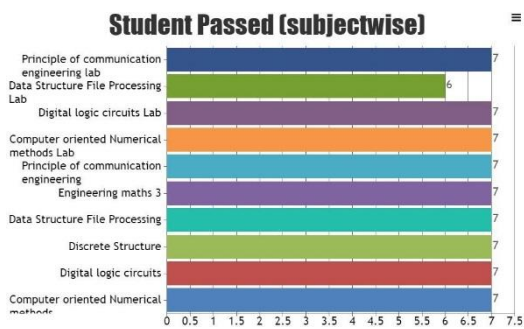


Fig. 6: Subject wise performance

9.2 Branch Analysis

By the analysis of Branch Average Performance, the teachers, as well as students, will understand where their branch/department lies in the institution does academically. This is the Roll up operation used in this analysis which gives overall branch performance.

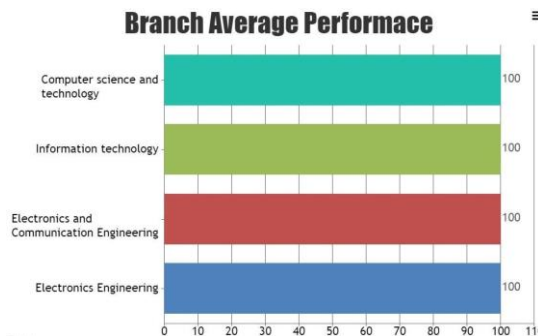


Fig. 7: Branch performance

9.3 Infrastructure Analysis

In this analysis, the students and teachers would know the number and percentage of the work- ing and non-working equipment's as well the books available and unavailable.

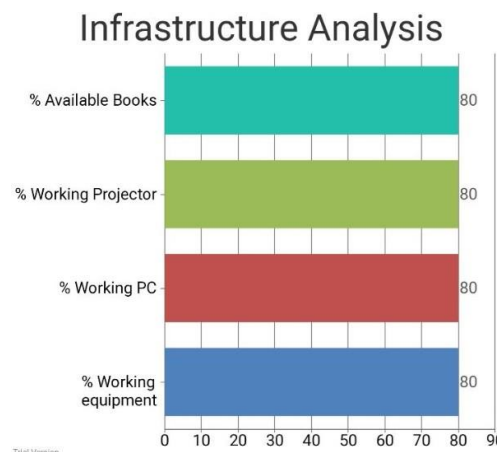


Fig. 8: Infrastructure analysis

9.4 Placement Prediction

The student's eligibility after this analysis based on their academic score as well as extra skills which will help them prepare beforehand for the placements.

Student Name
Aarti Vijay Jalgaonkar

Roll Number
01

Mobile Number
9146698774

Branch
Computer science and technology

Eligible ;
Yes

close

Fig. 9: Placement prediction

There is an analysis of many other things considering various factors like the following:

- The trend analysis for the branch will help the institution to keep the record of the students that are interested in a particular department or branch and on the basis of this, they

can take decisions on whether or not to increase/decrease the seats of a particular branch.

- According to the analysis of students interest, the institute can make a decision on which the topic to be introduced newly in the curriculum. Due to this, the students can get exposure to the latest or upcoming technology which will be helpful for them in future.
- In students average score performance, the students can predict their difficulty level of each subject.
- In each student's performance analysis, the student can see the analysis of their academics score, graphically by which they can improve in certain areas or subjects which will help them in the curriculum. Slicing operation is used in this analysis. The extra-curricular activities analysis help the students to understand and improve their other skills and they can predict where they lie in the fields other than academics.

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