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# Analysis and Design of Educational Institution database Visualization using Power BI Tool

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**ABSTRACT:** Data set visualization is the process of understanding what data matters through visual context and data analysis phase is done after data cleaning Today visualization is very useful in business intelligence analysis in general, there are different ways of visualizing data sets, can be dynamic or interactive in nature, This paper deals with communication Visualization of educational institution database using Microsoft Power BI Tool with different modules and this paper focuses on process model , Microsoft Power BI applications, various data sources in Tool and its various related visual or reference materials.

## I. INTRODUCTION

Data visualization is the process of understanding the importance of data by visualizing the content, it is a part of analysis, there are many ways to visualize data such as interactive and dynamic in events and visual content, there are many ways such as plans, graphs, slides. . . , stacked charts, histograms, bar charts, tables, matrices, and other forms of visual content; In this article, we will focus on interactive data visualization through Microsoft Power BI tools. Microsoft Power BI is a set of business intelligence and analytics tools for analyzing information and sharing insights and getting quick answers with interactive data visualizations using dashboards available on any platform. Devices like app, desktop, mobile and more. By visualizing the effects and filters, users or individuals can understand the information easily and conveniently. It has a five-element structure as described below, followed by Power BI service, Power BI gateway, Power BI Desktop, Power BI app, and Power BI connector. It is shown in Figure 01. The Power BI service is the centerpiece of the design, where reports are created in dashboards to be integrated across the organization; Power BI Gateway, Power BI Desktop, Power BI App, and Power BI Connector are shown in Figure 01. 01. Power BI service is at the core of the architecture where reports are published to dashboards to be shared across the organization. Power BI gateway is another important part of the design process. Based on connectors and protocols, Power BI Desktop is content in architecture where tools are used to analyze and manipulate data from specific processes and publish it on the web from many visions, tools and advertising features.

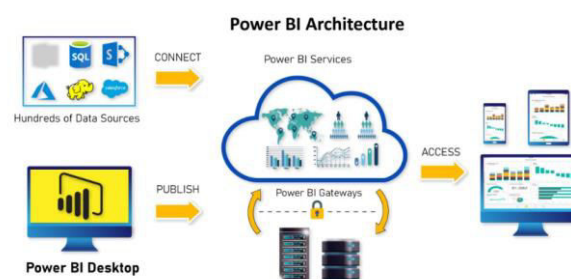


Fig. 1: Architecture of Microsoft Power BI

Power BI applications form the basis of the user side. Dashboards are viewed and accessed through certain applications, such as Power Apps and Mobile Power BI. Power BI connectors play a role in using connectors to retrieve data from databases and other sources. Database Engine, Azure Consumer Insight Connector, etc. like. The general functionality of Microsoft Power BI is as follows: 1) Get data from required data 2) Analyze data from connections and

gateways of the organization 3) Create reports from different views and filters 4) Use the following methods to publish to the web: Power BI Desktop 5) If changes are required, modify the report and report by creating an embedded URL in the Publish to Web option 6) Save from various applications from Microsoft (such as Power Apps, Mobile Power BI) Get information 7) Refresh version notification Use different gateways of the organization to update dashboard information . In this article, we cover the process structure and visualization of the Power BI tool and interactive data visualization for analyzing and creating data visualization in Educational Institutions.

## **II. TYPES OF VISUALS IN POWER BI**

Microsoft Power BI visualization products provide excellent data that can be used to extend Power BI. Microsoft Power BI includes 20 different types of visualizations and more from that, the basis for working on them, and testing methods that allow you to create accurate charts. The framework provides all the interfaces needed to complete selection, filtering, and other UI experiences with Power BI. The code is written in TypeScript, making it easy to build and debug. Everything is compiled to JavaScript and executed in modern web browsers. Images are created using D3, but you can use your favorite tools like Canvas, SVG or Web GL. This gives you everything you need to create custom visualizations for Power BI.

There are two types of visualizations in Power BI: 1) Microsoft Visuals, 2) Special visual effects.

### **1) Microsoft Visuals:**

These are visual effects provided directly by Microsoft, including charts like stacked bar charts, line charts, area charts, clustered bar charts, waterfall charts, group charts, slices, tables, and matrices. They're built into the software and are trustworthy.

### **2) Visual effects:**

These visualizations are created by individuals or entities external to Microsoft, such as developers or other users. They aren't pre-installed in the software but can be integrated to provide additional options like dot plots, route maps, flow maps, journey charts, and scrollers. These visualizations are developed by third parties, including Microsoft employees, and offer specialized features to enhance your data presentations.

## **III. PROCESS MODEL OF POWER BI**

The process model comprises seven steps, outlined below :

a) Data Acquisition: At this stage, users retrieve data from various sources, including files, databases, Microsoft Azure, online services, and others, as detailed in the available data sources.

b) Data Retrieval: Here, data selected through browsing data locations or via queries by choosing types of data sources and connectors.

c) Data Processing: This stage involves manipulating and refining the data using various operations while loading it into Power BI.

d) Data Analysis: Data is examined using filters, conditional queries, and other operations, including addressing erroneous data in columns.

e) Data Visualization: Analyzed and processed data is presented visually using tools such as Microsoft Power BI Visuals and Custom Visuals, encompassing plots, graphs, slicers, KPIs, etc. Subsequently, the report is published to Power BI services.

f) Report Refinement: In this phase, the published report undergoes finalization, rectifying errors and making necessary adjustments, such as resolving filter or visual issues. Upon completion of the editing process, the report is ready for

publication on the web.

g) Web Publication: As mentioned earlier, this stage involves converting the report into a dashboard format, making it shareable via URLs, websites, etc.

#### IV. DETAILS OF DATA SOURCES

*Table 1: Data Source Specifications*

Data format	Sources
Files	Excel, Text/CSV, XML, JSON, Folder, SharePoint Folder
Database	SQL Server, Access, Oracle, IBM DB2, IBM Informix, IBM Netezza, MySQL, PostgreSQL, Sybase, Teradata, SAP, Google BigQuery, and more
Azure	Azure SQL Database, Azure SQL Data Warehouse, Azure Blob Storage, Azure Table Storage, Azure HDInsight (HDFS), and more
Online Services	Power BI Service, SharePoint Online List, Dynamics 365, Microsoft Exchange Online, Salesforce, Google Analytics, Facebook, GitHub, and more
Other	Web, SharePoint List, OData Feed, Active Directory, Microsoft Exchange, Hadoop File (HDFS), R Script, ODBC, OLE DB, and more

#### V. LITERATURE REVIEWS

Marija Blagojevic et al. [1] conducted research on enhancing web-based intelligent reports in e-learning systems using data mining techniques, particularly focusing on the PDCA method (Plan, Do, Check, Act). Their study demonstrated improvements in predicting behavior patterns, leading to increased participant engagement. The findings highlighted enhancements in the report system of Learning Management Systems (LMS) or e-learning environments, along with the development and implementation of new modules.

Daniel J. Power [2] investigated data-driven decision support systems and their significance in Business Intelligence. He emphasized the necessity of updating or replacing mainframe-based decision support systems with web-based or web-enabled alternatives. The accessibility of data-driven decision support systems has expanded with the advent of open-source software, new hardware, and web technologies.

Zhijun Ren [3] explored the delivery of comprehensive Business Intelligence solutions using the Microsoft Business Intelligence stack. The study outlined the features and advantages of Microsoft's Business Intelligence stack, emphasizing the integration of various technologies such as databases, connectors, SharePoint servers, and business intelligence tools. This integration facilitates the faster delivery of comprehensive business intelligence solutions within

an enterprise.

Guangzhi Zheng et al. [4] investigated the integration of Business Intelligence with healthcare informatics curriculum. Their research underscored the importance of incorporating Business Intelligence into healthcare information technology programs, as both industry and academia recognize its significance. The study highlighted the previously neglected role of Business Intelligence in healthcare informatics and advocated for its incorporation into educational curricula.

Michelle Hoda Wilkerson et al. [5] examined youth reasoning with interactive data visualization, focusing on how interactive data visualization aids youth in understanding data. They concluded that supporting learners in coordinating their chosen resources is more beneficial than prescribing a specific approach or sequence of resource use.

Yuri Vanessa Nieto et al. [6] developed an academic decision-making model for higher education institutions using learning analytics. Their work involved modeling and constructing a software architecture for creating and categorizing indicators. The proposed software architecture facilitates the integration of learning analytics indicators and supports decision-making processes in universities.

## VI. METHODOLOGY

In Power BI, data can be fetched using the "Get Data" function from various sources, including Files, Databases, Azure, Online Services, and others. After selecting the data source, data can be imported via queries (for non-file sources) or by selecting files from folders. Once the data is loaded into Power BI, it should be analyzed and corrected for errors using the "Edit Queries" function. Relationships between different datasets can be managed in the "Relationships" section. If conditional columns or additional data need to be added, this can be done through the "Edit Queries" function. The next step is to create a report by clicking on the "Report" option, which opens a blank canvas for designing the report. The data is visualized using various Power BI visuals such as stacked bar charts and column charts. After creating the report, it can be published to Power BI Services. Users need to log in to Power BI Services, where they can edit the report if necessary. The report can then be added to a dashboard and published on the web. An embed link is generated, which can be shared on websites or with individuals.

This methodology includes two types of modules: Faculty Module and Student Module. The Faculty Module consists of submodules for Student Internal Marks Progress and Placement Progression, while the Student Module includes a single module for viewing their data. The following are pseudo-code algorithms for processing and visualizing data in these modules:

### Pseudo Code Algorithm 1:

Start

Get 'Pi'

View 'Pi'

Initialize Pat, Pt1, Pt2, Pha, Pq, Pch, Pca

Process Pi using string operations

Edit the dataset 'Pi' to add new conditional columns: Pap, Pam, Pt, Pttm, Pfs, Pape, Pt1pe, Pt2pe, Pqp, Phape

Create new column Pap:  $Pap = Pca / Pch * 100$

Create new column Pam: Pam = If Pap == 100, 5

Else If Pap >= 95, ...

Create new column Ptm: Ptm = If Pt1 < Pt2, ((Pt2 \* 0.75) + (Pt1 \* 0.25))

Else ((Pt2 \* 0.25) + (Pt1 \* 0.75))

Create new column Pt: Pt = Pat + Pha + Pq + Pam + Ptm

Create new column Pfs: Pfs = If Pt >= 16, "Promotion"

Else If Pt < 16, "Detention"

Else If Pap < 65, "Detention"

Else If Pap > 75 && Pap <= 100, "Promotion"

Else If Pap >= 65 && Pt >= 16 && Pap < 75, "Condonation"

Else "Error"

Create new column Pape

Create new column Pqpe: Pqpe = Pq / 5 \* 100

Create new column Phape: Phape = Pha / 5 \* 100

Visualize the variables using different visuals

Publish the report to Power BI Services.

### **Pseudo Code Algorithm 2:**

Start

Get 'Pii'

View 'Pii'

Initialize Pid, Pna, Pup, PQf, Pbr, Pst, Pcn, Plp

Process Pii using string operations

Visualize the variables using different visuals

Publish the report to Power BI Services.

**Pseudo Code Algorithm 3:**

Start

Get 'Piii'

View 'Piii'

Initialize Pap, Pam, Pt, Ptm, Pfs, Pape, Pt1pe, Pt2pe, Pqp, Phape, Pfs (similar to Algorithm 1)

Process Piii using string operations

Visualize the variables using different visuals

Publish the report to Power BI Services.

As shown in the pseudo-code algorithms, data such as Pi, Pii, and Piii is imported from different sources via the "Get Data" function. After viewing and correcting the data, columns are initialized and conditional columns are created using string and mathematical operations. The datasets are then visualized using Power BI visuals, completing the report process. The report is published to Power BI Services and shared via an embedded link or URL, which can be distributed directly or via platforms like SharePoint and websites.

**VII. RESULTS AND DISCUSSION**

Once the dashboard is published to Power BI services, further editing operations can be performed. If any filters or visuals are not properly accessible, they can be corrected at this stage before the final publication on the web. Additionally, dashboards for various modules within educational institutions can be created, covering aspects such as staff, infrastructure, and other amenities. After making necessary edits, the reports in Power BI Services can be shared and published to the web using the appropriate publishing option.

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