

# A BUSINESS INTELLIGENCE DASHBOARD

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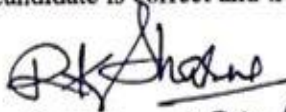
## CERTIFICATE

I hereby certify that the work which is being presented in the thesis entitled, "*A BUSINESS INTELLIGENCE DASHBOARD*", in partial fulfillment of the requirements for the award of degree of Master of Engineering in Computer Science and Engineering submitted in Computer Science and Engineering Department of Thapar Institute of Engineering and Technology, Patiala, is an authentic record of my own work carried out under the supervision of *Dr. R.K. Sharma* and refers other researcher's work which are duly listed in the reference section.

The matter presented in the thesis has not been submitted for award of any other degree of this or any other University.

  
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This is to certify that the above statement made by the candidate is correct and true to the best of my knowledge.

  
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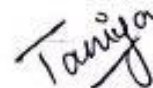
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## ABSTRACT

Effective reporting is critical to task accomplishment amid its life expectancy. In the present environment with the advances in innovation, managers and executives are reading reports on the move and this is the reason succinct examination is critical.

The objective of this venture was to make a Performance Dashboard idea that will fill in as a diagram for the future improvement of a data dashboard that measures the execution over the endeavor. The dashboard would enable managers to choose certain key execution pointers to show and would give constant updates at whatever point is conceivable. The implementation within an organization will standardize data sharing and performance measurement practices.

Execution information from different information sources is merged and exhibited to the decision makers. Choices depend on certainty as opposed to judgmental deduction, performance metrics are utilized to drive productivity and the dashboard usage gives a stage to business and operational magnificence.

The dashboard is intended to help the accompanying key goals, to give visual representation of key business regions and to give interpretation of information and execution comes about. Different pointers are chosen for various levels of administration and parts.

We are hopeful that implementation of this work help the organisation in improv-ing the business decisions and thus increasing the profitability of the business.

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# LIST OF ABBREVIATIONS

BPM	Business Performance Management
KPI	Key Performance Indicators
ISU	Information System Use
BI	Business Intelligence
ICT	Information and Communication Technology
ERP	Enterprise Resource Planning
OLAP	Online Analytical Processing
UI	User Interface
API	Application Programming Interface
ETL	Extract Transfer Load
SAML	Security Assertion Markup Language
SSO	Single Sign-On
RBAC	Role Base Access Control

# CHAPTER 1

## INTRODUCTION

Enterprises are utilizing data innovation arrangements with a specific end goal to expand their efficiency and their business esteem in the commercial center by portraying and checking their business tasks. These days, numerous sellers give modern tools to represent business process models and business action observing models. Business Performance Management (BPM) incorporates a suite of parts that are utilized to screen the strength of the business. The reconciliation of different frameworks in the business takes into account persistent observing of business execution, utilizing precisely chosen measurements, otherwise called Key Performance Indicators (KPIs).

The KPIs are shown to the expert through a dashboard, that is, a User Interface(UI) that arranges and exhibits data in a way that is anything but difficult to peruse and decipher. Dashboards are basic components in the everyday activity of present day undertakings, as they give to the experts the perspective of all the basic business measurements that mirror the performance of the business.

One can think of having the following features in a business value dashboard :

- (a) Instinctive designs, graphs and measures are being conveyed with visual bits of knowledge into the association among IT and business results progressively.
- (b) Absorbs, accommodates, enhances and analyses information from various, diver-gent sources over the venture for a brought together perspective of administration well being.
- (c) Provide details regarding its esteem commitment to illuminate basic leadership, authoritative and system change.
- (d) Drive joint effort amongst business and IT pioneers and uncover better approaches to drive business development, meet and surpass client desires.

We designed an iterative GUI for business performance reporting. The GUI serves as a major tool in decision making in various projects. The dashboard implemented is a management tool which is project driven and can be coordinated with the business execution models to receive the business execution displaying structure and extend it to catch the detailing part of the business. The work includes more highlights, for example, reconciliation of business knowledge advances, information mining and information perception advances to break down the business patterns, business development and zones of enhancements.

## 1.1 Background and Motivation

Empowered by fast advancement in data frameworks and innovation, organizations nowadays make a huge measure of information exchange. An expanded accessibility of applicable information is evolving basic leadership societies in associations. The past examination, which because of inaccessibility of required quantitative information regularly depended on instinct and experience of administration, are being supplanted by choices in view of certainties. While the previously specified wealth of information causes directors to settle on better choices, it likewise troubles them with data overburden. Execution dashboards effectively address this issue with a successful perception of a lot of information to enable managers to cut up it for better investigation, knowledge and revelations. Moreover, it diminishes the psychological weight of data overburden by maintaining center just around chosen key execution parameters.

Execution dashboards are, indeed, execution administration frameworks that show key execution measurements on one screen. They converge two intense orders: business intelligence and performance management. In the event that performance management deals with standards and procedures for business execution, business intelligence conveys technical arrangements. The already specified pattern additionally impacts performance management and estimation in acquisition and store network administration. While there are consultant-oriented materials about dashboards, even then less is known about how performance dashboards are used in procurement performance management.

Information system use (ISU) includes the basics for data framework achievement and connects straightforwardly to the client fulfillment with the framework. The execution dashboards as an administration, implies that client fulfillment with the framework is of a high significance for the plan of action. It would limit the hole between the organization's information of the product abilities and the degree the end-clients really utilize the product. Besides, this data could be utilized by application engineers, venture administrators and administration directors of the association to guarantee consistent change of the framework, benefit, client support, and preparing rehearses.

## 1.2 Organization Need

Execution dashboards are producing a ton of buzz nowadays, which may make them ponder whether our association needs dashboard programming. Without finding out about our business we can't state conclusively that it would profit by dashboard programming, yet numerous associations of every kind imaginable do. That is on account of much similarly a car dashboard furnishes the driver with key information about their vehicle, a business dashboard offers its client an abundance of information about different parts of business performance.

The preferred standpoint to utilizing a dashboard framework is that it enables the individual advertiser to stay concentrated and on errand, while having a steady indication of her execution and what despite everything she needs to achieve. For the entrepreneur or administrator it gives a basic method for following the execution of representatives and their projects.

It records vital measurable information, the different measurements utilized as a part of showcasing administration translate the information to give meaning and a conceivable sign of changes that should be actualized. These analysis tools let those accountable for advertising endeavors break down execution and figure comes about. For example, measurements utilized as a part of site showcasing measure the viability of promotions by following the navigate proportion, the cost per snap of every advertisement, rate of profitability and cost per order.

The execution dashboard can be considered as a business management tool that is being used to show, clearly and succinctly, the health and status of an organization by means of the key project metrics: technical indicators, schedule, scope, risks, resources and checklist. The Business Intelligence (BI) is a key constituent of any execution dash-board.

## 1.3 Business Intelligence

BI is the arrangement of systems, forms, applications, information, items, advancements and specialized designs which are utilized to help the accumulation, examination, introduction and scattering of business information [6]. BI advancements give memorable, existing and prescient sights of business tasks. BI can be utilized as an arrangement across the board scope of business choices reaching out from operational to tactical.

Strategic business choices incorporate needs, objectives and bearings at the broadest level. BI is best when it partners information from organization sources interior to the business, for example, money related and tasks information (inside information) with information subordinate from the market in which an organization works (outer information). It is extremely hard to recover sensible data in regards to the business just with the crude information.

BI advancements can deal with a lot of organized and in some cases unstructured information to help distinguish, create and generally make new vital business openings. Distinguishing new openings and executing a successful system in view of bits of knowledge can give organizations an aggressive market advantage and long haul stability.

Business insight can be utilized by endeavors to help an extensive variety of business choices extending from operational to key. Whenever joined, outer and inward information can give a total picture which, in actuality, makes a "knowledge" that can't be achieved from any particular arrangement of information. Business knowledge tools engage associations to pick up understanding into new markets, to survey request and appropriateness of items and administrations for various market sections and to measure the effect of promoting endeavors.

## 1.4 Data Visualization

Visualization is the graphical portrayal of a data. The significant objective of information representation is to give the client a subjective and simple comprehension of the data substance. It is the way toward changing articles, numbers and ideas into a shape that can be effectively deciphered by the human eyes. For the most part, data, can be information, relations, discernments or procedures. In the study, information is confined to data.

Data Visualization is seen by numerous orders as a cutting edge likeness visual correspondence. It includes the creation and investigation of the visual portrayal of data. To impart data obviously and productively, information perception utilizes factual illustrations, plots, data designs and different instruments. Numerical information might be encoded utilizing spots, lines, or bars, to outwardly impart a quantitative message.

Effective Visualization enables clients to examine and reason about information and confirmation. It makes complex information more available, reasonable and usable. Clients may have specific scientific assignments, for example, making correlations or understanding causality, and the outline standard of the realistic (i.e., indicating examinations or demonstrating causality) takes after the errand. Tables are by and large utilized where clients will look into a particular estimation, while outlines of different sorts are utilized to indicate examples or connections in the information for at least one variables.

Data representation essentially alludes to the strategies used to impart information or data by encoding it as visual items (e.g., focuses, lines or bars) contained in illustrations. The objective is to impart data plainly and productively to clients. To pass on thoughts viably, both stylish shape and usefulness need to go as one, giving experiences into a somewhat scanty and complex informational collection by imparting its

key-viewpoints in a more natural manner. It is firmly identified with data illustrations, data representation, logical perception, exploratory information investigation and measurable designs and includes particular wording, some of which is gotten from insights.

Two essential sorts of data shows are tables and graphs:

- (a) A table contains quantitative information composed into lines and segments with unmitigated names. It is essentially used to look into particular qualities.
- (b) A diagram is basically used to demonstrate connections among information and depicts esteems encoded as visual articles (e.g., lines, bars, or focuses).

Data introduction design is a range of abilities that looks to recognise, find, control, format and present information so as to ideally impart meaning and legitimate knowledge. The principle objective is to utilise information to give learning in the most proficient and powerful way conceivable.

## CHAPTER 2

### LITERATURE SURVEY

#### 2.1 Overview

For writing review, the works that have been already done in building a different dash-board utilizing the distinctive advances and methodologies is considered. For example, a review done in 2004 by The Data Warehousing Institute announced that about portion of the 473 business knowledge experts were utilizing dashboards and that a further 17 level of the respondents were building up a dashboard arrangement in their organiza-tions.

Another report distributed in demonstrated that dashboard has been quickly supplant-ing detailing and specially appointed investigation in Western associations. Numerous writings have been distributed so far in view of the specialized plan of the dashboard, however few are distributed about utilize dashboard as the usage for execution of an organization.The execution of dashboard can encourages as a significant knowledge for organizations through trading data among various gatherings. This administration of data backings to quantify the exhibitions of the representatives of an association con-cerning critical thinking, work coordination and client service.

The investigation recognized three reasons for dashboard as

- (a) Decision settling on and choice think,
- (b) Communication and consistency
- (c) Self-observing. Dashboard imparts fundamental information or data to the leader through perception process.

Under time weight, authoritative chiefs or leaders may like to utilize wellsprings of information or data and its quality as far as exactness, dependability and opportuneness that gives better availability to data. By actualizing ICT driven dashboard UI, clients would have the capacity to quick availability of data with moderately low exertion. In the writing, dashboard is viewed as cooperative device instead of individual choice, an emotionally supportive network that assists to convey the qualities and goals of the or-ganization. Due to quick development of information and in addition revealing needs in associations, the dashboard can be considered as the new exceptionally pertinent promising device for information mining and consistent reviewing in future. It is called attention to by past scientist that there is an absence of learning identified with the con-venience and execution of dashboard in the information observing and administration in an association.

- (a) The work introduced by Elliot et al. [7] depicts new improvements to a military restorative informatics and business process reengineering research venture. A Business Intelligence framework called the JMAR Executive Dashboard Initiative (JEDI) helps in taking a productive choice with respect to the medicinal.
- (b) Ashraf et al. [6] characterizes the key measurements to incorporate into BI Dash-boards to help envision the correct measurements precisely to chiefs for a powerful market edge. The work proposes three business measures and reviewing basis for esteemed supporters in view of call detail records and shows the outcomes in a viable representation.
- (c) The work displayed by Chowdhary et al. [8] depicts an approach for dashboard advancement that is show driven and can be coordinated with the business execution models to receive the business execution displaying structure and extend it to catch the detailing part of the business.
- (d) The work done by Jaison et al. [2] manages taking care of vast arrangement of dynamic information and the technique to speak to it in program.
- (e) The work exhibited by Kumar et al. [3] portrays building an operator based model

of securities exchange which break down the chronicled information and decide the ideal market value.

- (f) The work exhibited in this report is motivated by the work proposed by [3], [6], [7]. For example, the idea of utilizing the Business Intelligence for better bene-fit, the information warehousing for information stockpiling and use of represen-tation for better understanding. In any case, this work includes more highlights, for example, reconciliation of business knowledge advances, information mining and information perception advances to break down the business patterns, business development, measure of benefit, worker execution, consumer loyalty and zones of enhancements.

## 2.2 BI Framework Proposal

In the mid-1990s, the BI framework that was generally acknowledged was the information distribution center. An information distribution center is a subject-situated, incorporated, time differing, and non-unpredictable gathering of information that is utilized principally in hierarchical choice making. Though an information stockroom was ordinarily utilized, it was just useful to individuals who were exceedingly PC educated.

The primary issue looked by the business clients while settling on choices is exploring through gigantic information stores or information distribution centers and associating the data. So as to get to the information business clients must be subject to the IT office. BI dashboards help in taking care of this issue by solidifying and making data accessible on a solitary screen. A BI dashboard enables business clients to have finish control over how they deal with the information while IT can be more required with innovation incorporation, upkeep and support. Disjoining this reliant relationship brings about speedier and better decisions [3].

The nature of choices depends exceptionally on information quality. Accessibility of information is additionally considered as an information quality issue. When contrasted with an information distribution center, the information in a dashboard originates from different sources including information stockrooms, spreadsheets, interior applications, outer administrations and independent applications. In an overview did by Hurwitz and Associates, it was discovered that the organizations depending on information distribution centers and solitary databases meet under 50 percent of their business prerequisites. As per the review, the majority of organizations consolidate their information distribution center and outside applications to the dashboard to accomplish better performance.

ERP frameworks are additionally one of those devices that are required to enhance the basic leadership abilities at the official level. Associations depended on budgetary frameworks (Enterprise Resource Planning (ERP)) for examination and detailing. Despite the fact that they were solid in exchange preparing they were not effective for running questions and report age. ERP frameworks were not intended to run client par-

ticular reports (Davison, 2002). Notwithstanding, such reports are vital for the basic leadership process in any association. The principle explanation behind its confine-ments is that ERP frameworks need in giving a dashboard.

During 2001, because of the impediments of past frameworks and powerfully changing business necessities, a requirement for another apparatus emerged that would encour-age the directors and administrators watch out for the association's execution without exploring through complex databases. The new BI demonstrate should have been com-posed with the end goal that it would not require strategic and operational chiefs to run the online analytical processing (OLAP); it would make information accessible as reports and pointers that would prompt enhanced execution. Essential plan issues that incorporate information quality, light engineering and markers would need to be fused in the BI framework. The aftereffect of these impediments was the making of the dash-board.

As contrasted with other BI frameworks, dashboards have made the way toward break-ing down information simple for the experts by giving information through a solitary UI. Preceding the presence of dashboards, investigators were required to experience heaps of information with a specific end goal to figure benefits, costs and quarterly outcomes. A dashboard comprises of a static structure that makes data accessible at the opportune time utilizing indicators. During unforgiving financial circumstances, ad-vancement of business procedures to cut cost and time is extremely basic. Dashboards have been appeared to be a helpful interest in such circumstances.

# CHAPTER 3

## BUSINESS DASHBOARD

In spite of their pervasive presence in business, dashboards can be problematic to develop, design, implement and frequently fail to accomplish their objectives. Common glitches include misalignment of dashboards with the business goal line, impractical or poorly defined objectives and business problems impacting the implementation.

The proposed dashboard development architecture involves two major steps - Business Architecture and Technical Architecture. The design features are differentiated into functional and visual features as shown in Figure 3.1.

- (a) Functional highlights portray the dashboard's capacity which bars the dashboard perception introduction. Such highlights incorporate introduction arrange type, sit-uation examination, bore down, and penetrate up highlights.
- (b) Visual highlights, then again, allude to how the information is displayed to the client. For instance, the utilization of matrix lines, single pages, and the shading blends.

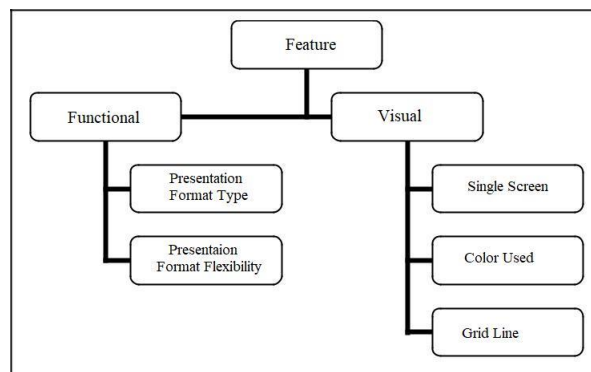


Figure 3.1: Dashboard's Feature Categories

The distinguished four motivations behind dashboards are Consistency, Monitoring, Planning, Communication. Figure 3.2 demonstrates the general dashboard's motivations distinguished in this investigation. Despite the fact that each level may have similar purposes, however they are not working a similar way. For instance observing purposes, each level need to screen their execution in alternate point of view. In key level, the administrators are observing the association's general execution. In the in-terim for strategic purposes, the center directors are observing departmental execution. Then again, the operational levels are checking their individual performance.

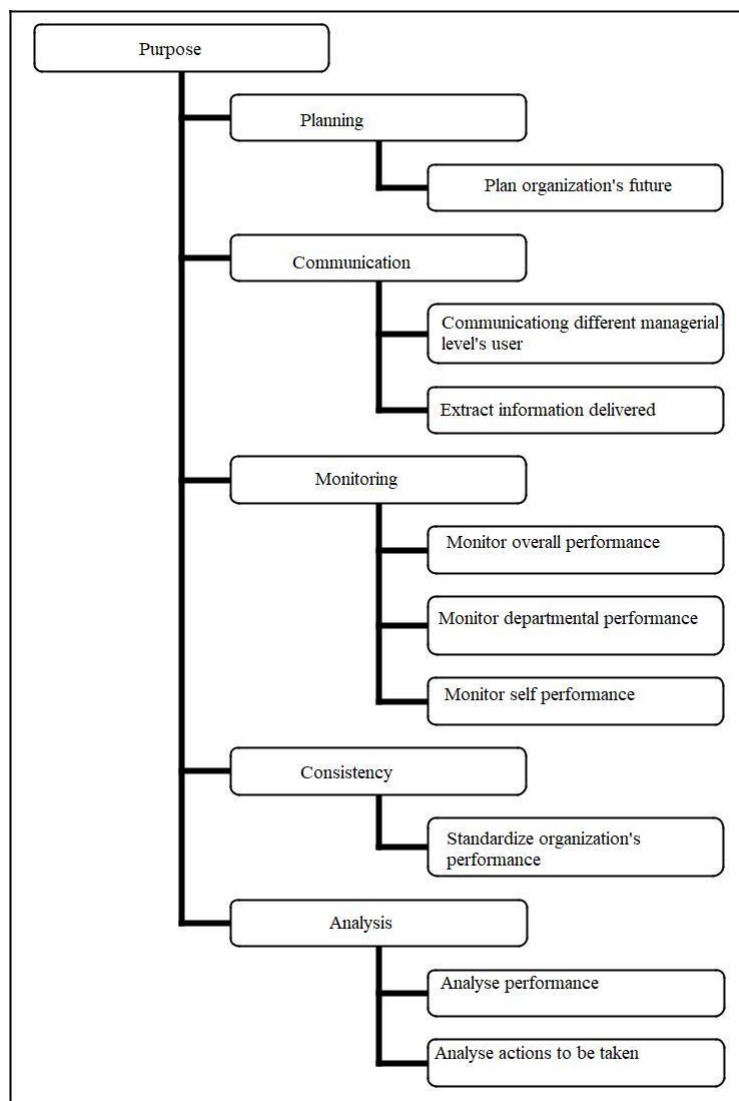


Figure 3.2: Dashboard Purposes

## 3.1 Business Intelligence Tools

Business intelligence (BI) reporting tools are mainly used for data visualization such as designing charts and other info graphics for building dashboards to display business metrics and key performance indicators. BI reporting tools can be divided broadly into two major categories.

- (a) Guided reporting and analysis - This focus majorly on traditional BI reporting services which has been used by industry since long. They are highly power pack-ages, well-established and scalable to handle large data files and serve the best out of it. Ex. Reports, Dashboards, Spreadsheet integration, BI search.
- (b) Self-service BI - This majorly focus on those areas which requires performing ad hoc analysis of data. This enables business users to add complex calculated metrics, schedule refreshing of newly added data and helps to perform deep dive analysis. Ex. OLAP, Data discovery, Ad-hoc analysis.

### TOP BI TOOLS

- (a) Tableau is leading the market since long. This tool can help to create beautifully visual appealing charts, reports and dashboards with the connection to any data sources. Tableau gives instantaneous look to the dashboard within fraction of sec-onds by drag and drop interface.
- (b) Power BI is a cloud based data analysis and reporting tool which is new in the market but its components such as Power query, Power pivot and power view are in market since so long. This tool is introduced by Microsoft which is growing very rapidly with new and unique features. Cost efficiency and flexibility of adding custom visuals increases the demand of this tool.
- (c) Qlik is the most flexible BI tool for turning data into knowledge irrespective of complexities of the data. Qlik is an In-memory tool with associative modeling

which correlates data into meaningful insights. Two Qlik products majorly used are Qlikview and QlikSense.

## WHICH BI TOOL TO USE?

Every BI tool has its own unique features and capabilities but when you look closer you will find that basic intent and structure of all BI tools are same. When considering the right tool for any organization, it is essential to take the decision based on the complexities of the data and the user experience required. Qlikview is highly adaptable BI tool and provides wide-ranging deep-dive analytics. For extensive data transformation and analysis even with un-structured data, Qlikview may well be a solid investment. Microsoft's Power BI which is reasonably priced tool, a fantastic asset for quick insights, user experience, and sharing reports/dashboards internally into your organization. This tool performs very well with extensive R, big data integrations and connection with cloud.

## BEST PRACTICES IN BI REPORTING TOOLS

If the BI solution does not improve performance, increase cost-effectiveness, or add value in some way then it is not a useful business solution. So, while designing any BI solution it is important to follow some best practices. The design and functionality of any BI tool will determine the amount of benefit that the users receive.

BI functionality and design best practices can be incorporated in the following two aspects.

(a) Aesthetics

(b) Data Modeling

## (A) AESTHETICS

Aesthetics plays a key role in any BI application. Front end visualization is the first visual experience that anybody sees which gives direct impact on the end users. Having good looking 'dashboards and charts will make presentations look enhanced, better perception of value delivered; improve the user experience and more questions answered. The opposite means a less focused outcome. Characteristics of good aesthetics-

- (i) Use of right color schema: Colors on dashboard are not only for good visual impact but for right communication with the user. Selection of colors for the dashboard needs proper understanding of human perception and the information that needs to be presented. Colors in dashboard should not be used to make it look pretty but also to communicate information effectively. So, soft colors should be used more often. Color schema should be consistent across the application i.e. mixing of distinct colors should be avoided. Encode quantitative data correctly with right selection of color scheme and avoid using unnecessary colors.
- (ii) Organizing the dashboard: Formatting involves everything that affects the visual appearance of a dashboard.
  - (a) Layout - All the objects should be symmetrically aligned to each other. Several scientific studies prove that symmetry is more eye-catching. If the layouts of visualization objects are symmetrical they will be more appealing, and users are more likely to engage with the content.
  - (b) Typography - This mainly includes choosing the right font type to pick the right point size which communicates effectively and is good visual appealing.
  - (c) Objects design - Placing the objects and its properties on the right place

where it's more visual appealing is the best practice that everyone should follow. Information that has been displayed should be less but accurate. Charts objects should be uncluttered, crisp and consistent which makes clean and readable dashboards.

A complete dashboard contains lots of other functionalities than simple charts. It should be more interactive to the user and give meaningful insights. Common other functionality that a dashboard has is Filters, search object, drill down functionality, export to pdf/excel and navigation buttons.

## STRUCTURE OF THE DASHBOARD

We should not show all the information collaborated at one place, the structure of your dashboard should be in a flow describing a story about the data which should be key metrics i.e. KPI's on top followed by context around the metrics and detail description with charts and functionalities on the bottom of the page. All the filters should be assembled at one place. They should be ideally placed at the right or left side of the dashboard, however this is not a mandatory rule, depending upon the scenario they can be placed on top as well.

## COMMON FORMS FOR DATA ANALYSIS

Comparison of data - Many times we need to show comparison between different items. So, to show highs and lows of data the best chart to use is bar or column chart.

(a) Transition of data - If we want to see how the data is performing at a specific time or trend over months and days, line or area chart will be extremely useful in these scenarios. Line chart should be used when you have a continuous data set.

(b) Composition of data - Sometimes we need to see how a data value breaks down into its constituents. Pie or scatter charts are best to use in this case.

## (B) DATA MODELLING

So far we have seen the best practices in terms of UI i.e. front end, but back end is the most important aspects which is known as data modeling in BI terminology. The data model consists of the data structure (including tables, relationships, rows and columns of the table), the actual content of the data (dimension/measure, date and time, primary and foreign keys) and the metadata. With an optimized data model, we can achieve the following functionality that improves the performance, speed and usability of the solution.

- (a) Adaptability - schemas that undergo enhancement of the tool.
- (b) Portability - schemas that can be hosted on different systems.
- (c) Efficient Storage - optimized schema disk footprint.
- (d) HighPerformance - optimized schemas that improve performance of the tool.

## 3.2 Business Architecture

The various success factors considered to develop effective dashboard from the business perspective are explained below:

- (a) Stakeholders Support: Dashboard initiatives need a champion, relatively a senior executive who has a complete understanding of business challenges and has adequate authority to make things happen. Senior executives essentially involved in retaining the initiative. In several cases, initiatives start with a great flourish but then focus swings to other priorities and teams mislay interest. Deprived of ongoing high-level support, dashboards risk fading into irrelevance and obscurity.
- (b) Strategy: In the Dashboard development process, the mission, vision, goals and objectives of an organization should be considered to build the respective metrics. In this step, all the information which previously brought profit to the company and the metrics which will lead to the future development of the company towards the profitability should be collected. Also, the inputs from the stockholders with respect to the upcoming strategies of the organization should be collected.
- (c) Tactics: As the growth of the company directly depends on the quality of the employees, the information regarding the employee knowledge, the work efforts, Projects and employee engagement is considered in this phase. The efforts of each employee must be monitored as it should be channeled towards the profitability of the company.
- (d) Semantics: On deciding the strategies and tactics, a precise metadata of the process should be created and conferred among the organization so that everyone will agree to the rules and terms. Then monitor the subsequent progress.
- (e) Proper metrics: The preliminary focus on business objectives permits definition of suitable metrics, those that are evocative to the business and the stakeholders. Effective metrics results in terms of defining significant action and improvement, rather than simply monitoring only the performance. A concentration on defining

appropriate metrics at the outset also dodges the problematic availability of data or tools and technologies, rather than the business aims, to drive the process, execution of the initiative irrelevant to performance issues. By choosing a few effective key metrics to start with, organizations can secure preliminary successes and improve more strategic elements and complexity.

# CHAPTER 4

## METHODOLOGY

Web applications are generally broken into coherent lumps called "levels", where each level is doled out a part. Conventional applications comprise just of 1 level, which lives on the customer machine, yet web applications loan themselves to a n-layered approach by nature. In spite of the fact that numerous varieties are conceivable, the most widely recognized structure is the three-layered application.

In its most normal frame, the three levels are called introduction, application and capacity, in a specific order. An internet browser is the main level (introduction), a motor utilizing some unique Web content innovation, (for example, ASP, CGI, ColdFusion, Dart, JSP/Java, Node.js, PHP, Python or Ruby on Rails) is the center level (application rationale), and a database is the third level (stockpiling). The internet browser sends solicitations to the center level, which administrations them by making questions and updates against the database and produces a client interface as depicted in Figure 4.1.

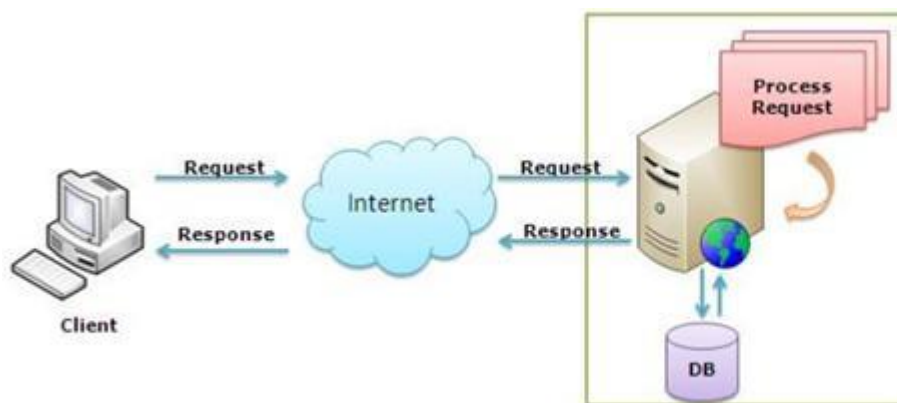


Figure 4.1: Typical Structure of a web based application

## 4.1 Architecture and Workflow

The performance dashboard architecture is given below.

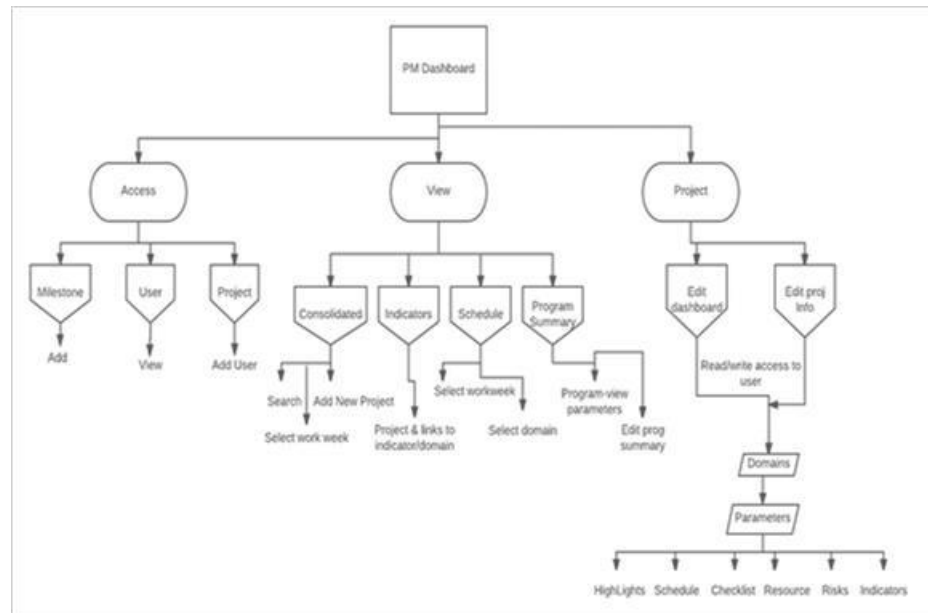


Figure 4.2: Project Management Dashboard Architecture

The dashboard is mainly divided into 3 main sections, i.e. access management, view management and project management.

- (a) Access management includes user management, project management and milestone management.
- (b) View management includes the parameter views, consolidated view (default), schedule view and indicators view.
- (c) Project management includes features to add new project and edit the existing projects. The dashboard highlights the project name (program), milestone, status and monthly reports.

Every program comes under 5 domains. Each domain includes certain parameters

- (a) Highlights - includes project major highlights i.e. brief and imp summary of the work done in that project till then.
- (b) Schedule - Includes the deadlines for meeting project requirements, delays in project and events.
- (c) Risks - Includes major risks involved in that project, keep track of risks open/ignored/closed and also what action is done for reducing the severity, seriousness, of the risk.
- (d) Checklist - ensure quality checkpoints for block deliverables.
- (e) Indicators - includes the results of the tools run on design. It basically displays error counts, status of a tool in a graphical representation.
- (f) Resource - Gives a graphical display of the count of total resource demands and supply for a project.

## WORKFLOW OF DASHBOARD

Figure 4.3 illustrates four stages of data in process of visualization:

- (a) Load: It is the first level when the page is loaded along with the data store.
- (b) Pre-process data: It is the second stage where we parse the dataset line-by-line, all the preprocessing is done in this stage, such as converting string types to date objects and grouping data points based on device.
- (c) Transform: In this level data is transformed based on the type of layout to be displayed. Such transformations are event driven and will be triggered by end-users with the help of controls in the dashboard. In this level data is aggregated based on what chart is being currently viewed.
- (d) Visualize: It is the final level where data is presented in the form of chart elements. Charts in this level are interactive and also allow the users to zoom and pane the data (when such interactions happen internally the data in the selected range is transformed and the chart is updated or refreshed).

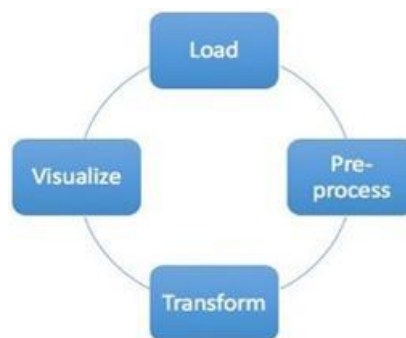


Figure 4.3: Illustrates various stages of data in the process of visualization

Figure 4.4 explains the internal architecture of the dashboard. Control collectively represents all the elements in the dashboard that help in navigating through the view, users can select different domains to view charts and select different available projects to view their trends; these objects are responsible for making the chart interactive.

Each control in the dashboard is registered with the dispatcher (listener) such that if an event takes place appropriate handler registered for the event handles the request. In turn charts view specific abstractions of data which helps user in finding trends, for this reason dispatcher is also responsible for transforming the data for specific view.

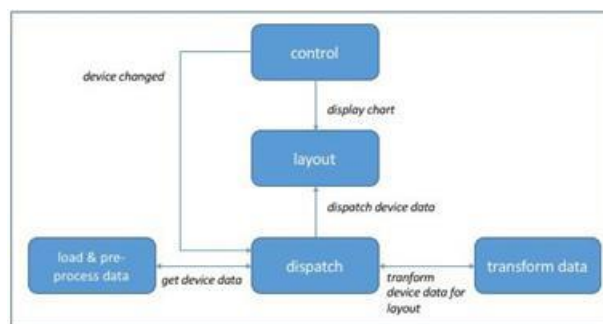


Figure 4.4: Internal communication architecture of the dashboard

## 4.2 Technical Architecture

The technical architecture as shown in Figure 4.5 can be segmented into the following five components as described below:

(a) Data Sources: In an organization, there will be various data source provides raw input data in different formats like structured or semi-structured or unstructured data. In fact, the data sources can be on premise or cloud. Some of the standard data formats are file based, API to extract data and can expose read-only database schema. Hence the dashboard architecture should be able to handle all forms of data Examples: JIRA, Footprints, Sales etc.

(b) Data Integration: Data Integration Layer is built using Pentaho Data Integration and helps to extract data from data sources, transform the extracted data to match destination format (SQL tables) and load the transformed data into the data ware-house. On identification of the data sources, a connection needs to be established to extract the data from the source to the application. The obtained raw data may consist noise. As mentioned in above section, the raw data may be structured or semi-structured or unstructured. Hence there is a need to perform Extract Transfer and Load (ETL) process as per the type of data before using it.

### (a) Extract

(i) If the data source is an Excel file then just create Pentaho transformation which extracts the rows of the excel sheets.

(ii) If the data source provides API to extract data and expose read-only database schema. Then, create Pentaho transformation which acts as a connector between Data source and the dashboard application. If the data source is expecting and authentication, then provide the required credentials to access the data.

### (b) Transform

The data from the Data source may consist of noise which leads to miss calculations while analytical process. The transforms process takes care of noise

reduction before using the data. Few noise handling methods in terms of transformations are as follows:

- (i) Default values can be provided for any missing fields in the data
- (ii) Providing the missing data values based relation with its adjacent data values
- (iii) Removal of unwanted columns or data which is not useful for the analytical computations

(c) Load

Once the noise is removed, the next step is to load the clean data to the application data base. To do this, respective Pentaho jobs should be created which load the data into the corresponding MySQL tables. To have an effort less interface or light weight load on the server, the separate schema for each data source is created.

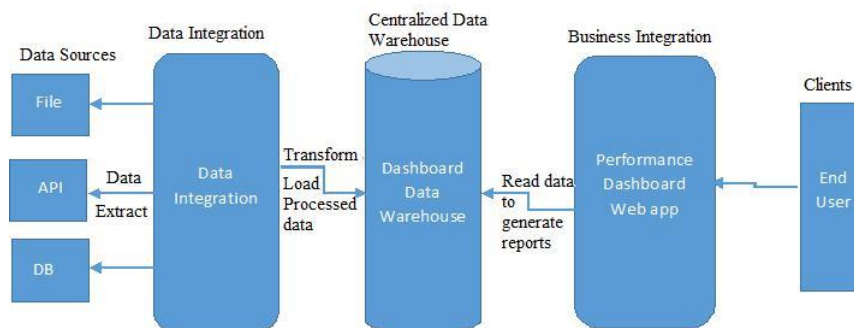


Figure 4.5: Technical Architecture

(c) Centralized Data Warehouse: Centralized data warehouse is built using MySQL server[3]. Data Integration Layer and Business Integration Layer make use of MYSQL connection pooling to read/write tables. Data from multiple sources irrespective of their location is stored in one single location. The dashboard has exclusive connectors for each data source which is built using Pentaho integration tool. These connectors will play the role of importing the data from all the data sources and storing in the Centralized data warehouse.

The implementation of the central data warehouse has a great advantage like, it provides data security, reliability and infrastructure cost reduction. Also, provides easy implementation of data mining and machine learning technologies which can be an additional advantage in dashboard developing process.

(d) Business Integration: It is the key component of the Dashboard. There exist few software companies which provide the business integration tool which can be directly integrated into the business organization. But each has their short comings. Either the products are too overpriced or do not provide all the required functionalities to build the model. Hence, the proposed model is a perfect solution as it uses only open source software which has the flexibility to alter and integrate in accordance to the organizational requirement.

The proposed Dashboard's Business Integration Layer is built using open source frameworks/libraries as follows:

(A) Frontend technologies:

The proposed dashboard is developed using the technologies like HTML5, CSS3, Java Script, jQuery, Bootstrap and High Charts [8]. The most important of these, the bootstrap and HighCharts are described below:

(i) Bootstrap:

One of the major challenges is the prediction of the device through which the user is accessing the Dashboard. If any user tries to access the dashboard with a device display other than the standard size, then the contents of the dashboard will be rendered in an abrupt manner. This may even

result in overlapping or miss few contents of the page itself.

Also, it is not a good practice to restrict the size of the device display to the user. This will directly impact on the user experience and a major short coming. To overcome this problem, the proposed dashboard is de-veloped using Bootstrap technology. This makes the pages of the dash-board responsive and the page contents will be re-sized as per the display size of the device.

Hence making the dashboard device independent. The proposed dash-board display is portable enough to work for a laptop, tablets as well as mobile phones.

(ii) High Charts:

In the proposed dashboard, HighChart graphical framework is used which provides a variety of graphs making an easy interpretation. It is very flex-ible and supports different kinds of data input like CSV, JSON, XML etc. It supports various libraries and provides few built-in functionalities like downloading the graph as image, excel, graph editing which reduces the development effort.

(B) Backend Technologies:

It is a key component reflecting the Performance of the application. The front end and back end are directly dependent on each other. So, designing of the back end has a direct impact on the user experience. The required data to the graphs present in the frontend is supplied by the backend services. In case the backend of the application fails then the application will not be accessible. The backend of Dashboard is developed using PHP and MYSQL which makes it reliable and flexible. The data after ETL step will be residing in the database. It is retrieved using the Web services and converted into a consumable format to the HighCharts and represented in the frontend as a graphical format. The framework allows to perform the CRUD - Create Delete Update Delete operations on the database. Required data is retrieved by custom queries to the database by establishing MYSQL connection.

- (i) Database: MySQL - MySQL is used to store the data in the Centralized Data Warehouse. Data which is retrieved from Pentaho connectors is stored in a structured schema.
- (ii) Security: Spring SAML security - SSO - All the multi-national companies will be using numerous application hosted within the organization. Generally, each of the application will be having separate URLs to log-in and respective authentication credentials. Being an employee, it is difficult to remember all the URLs of the application and corresponding credentials. To overcome this, the proposed dashboard is integrated with Spring SAML security- SSO. Security Assertion Markup Language (SAML) is an open standard for exchanging authentication information between a service provider-SP and an identity provider-IP . It acts as a single sign-on for different application.

(iii) RBAC - Role Based Access Control - As the dashboard contains various important business information. It is not recommended to provide access for all the employees of the company to all kinds of data of the dash-board.

There may be few sensitive information which must be maintained confi-dentially among the higher authority employees. The dashboard addresses this problem by implementing RBAC to differentiate user types and per-missions. Once the user logs in to the dashboard, the contents of the dash-board are filtered and displayed based on the designation in the company. The user will neither be aware of this filtering nor the user experience is affected.

(C) Clients:

End users access the dashboard web application using a browser on their com-puter/laptop or mobile phone. This web app is responsive and user experience is seamless across all devices.

## 4.3 Dashboard Development Stages

### (a) Selecting the Key Metrics

The two fundamental ways to deal with key metrics are : general and custom fitted. The general approach keeps the quantity of measurements down to the not many that can be connected to for all intents and purposes all settings and has the upside of likeness, permitting benchmarking across specialty units, firms, businesses, and eras.

The customized approach welcomes abnormal state correspondence all through the association of what is vital to the business, which is viewed as profoundly advantageous by a few organizations .It suggests that the individuals who will (an) utilize the framework, (b) be estimated by it, and (c) make decisions in view of it ought to be included. This approach fits with the dashboard advancement advantages of cross-functional joint effort and research.

### (b) Populating the Dashboard With Data

Utilizing as of now accessible measurements accelerates the procedure at a negligible cost, regularly by finding helpful intermediaries and additionally consolidating existing measures. Waiting for better measurements might be advantageous in the long run. The dashboard utilize changed promoting from revealing just productivity measurements to business viability measures.

Populating the dashboard with information is definitely not unimportant. As noted above, benefit firms have colossal amounts of information from numerous sources. Maybe the most serious issue is the periodicity of the information. A portion of the information might be gathered every day from deals reports, while other information are gathered yearly, or even less oftentimes, for example, mark value measures. A few measurements will be more vital than others and thought ought to be given to priorities [5].

### (c) Establishing Relationships Between the Dashboard Items

Stage III includes deciding the basic connections between the measurements. This progression moves the dashboard from a straightforward introduction of data (what we consider a base necessity for a dashboard) to a more profound comprehension of the business and a choice emotionally supportive network. Measurements alone don't address circumstances and end results connections for clear attribution of execution change or the capacities to produce and test elective blend allocations..

A dynamic framework approach in this manner seems, by all accounts, to be a consistent decision for assessing these connections and administrative judgments by means of choice analytics can be utilized to gauge a large number of the connections. Incredible vulnerability about the judgments or difference among the administration group may give motivating forces to start look into, as information collection, or experimentation, to better comprehend the relationships

### (d) Forecasting and Scenarios

Stage IV applies the dashboard's basic model to situation arranging and spending setting . For example, if the firm enhances estimate benefit request exactness (e.g., by utilizing information about past deals designs), it should improve incomes . Besides, utilizing imagine a scenario in which examination gives directors an instrument for assessing advertising efficiency.

### (e) Connecting to Financial Consequences

Stage V associates advertising consumption completely through the interval promoting measurements onto deals and to the budgetary results for the firm, including the connection to investor esteem and subsequently showcase capitalization, and in this way adjusts advertising with corporate objectives and the speculator's point of view. Research underpins that brand value, consumer loyalty, client value, and promoting exercises, for example, the company's publicizing are altogether connected to firm esteem.

## 4.4 Implementation Details

The usage of dashboards can be separated into keypoints as:

- (a) The key measurements for the organization are chosen.
- (b) The dashboard is populated with information.
- (c) Include the foundation of circumstances and end results connections between dashboard things, which includes a more profound comprehension of the business.
- (d) Empowers to imagine a scenario in which examination are done for determining and planning.

Henceforth, the development and achievement of a dashboard usage will rely upon how far the execution is inside its improvement cycle. Dashboard executions should begin from the end client, whose day by day undertakings incorporate the checking of the chose measurements.

According to Kawamoto and Mathers, one of the key achievement factors in dashboard usage is the recognizable proof of measurements. The measurements are wanted to be important and significant for partners. They ought to incorporate a blend of operational, money related and venture particular data. This concurs where non-money related measures are found to have a more noteworthy part in PM to have the capacity to impact monetary measures that investigate results. Moreover, dashboards ought to produce activities toward particular objectives, be intuitive and change after some time contingent upon the new business conditions.

The points of interest of the database, the instruments and advances and structure is examined in the following.

#### (a) Database

There are numerous information sources, for example, JIRA, Footprints, Zabbix and so on. Every datum source has diverse diagram. Maybe a couple of the database is organized and few are semi-organized. The points of interest of them are as follows:

- (i) JIRA - is Atlassian's issue and undertaking following apparatus. Basically: JIRA enables you to track any sort of unit of work (be it an issue, bug, story, venture errand, and so on.) through a predefined work process. Both the unit (what you call your thing of work) and the work process (the means that thing takes from open to close) can be exceptionally modified for your group's particular necessities, regardless of whether basic or more complex.

Collaboration's additionally a major purpose of accentuation in JIRA - saying, arranged remarking , and sharing issues by means of email all assistance make your work more unmistakable to your groups so people remain in agreement all through their undertaking, discharge, or set of tasks.

This information source comprises the data in regards to the representatives work endeavors as for the task inside the association. It comprises 4 long stretches of information, roughly 3 lakhs records and 30 unique tables.

- (ii) Footprints -It consists information regarding the number of service tickets or issues raised within the organization and the amount of time taken to resolve it. Also, the effort in resolving the respective issue. This schema also contains 4 years of data, approximately 2 lakhs records and 20 different table.

- (iii) Zabbix: This tool gives the information regarding to the health of the different organizational applications like application or server Uptime, Downtime, response time and download availability[1]. The schema contains 4 years of data, approximately 5 lakhs records.

- (iv) SFDC: It mainly consists information with respect to the product

end to end data that is from placing an order to the product delivery can be obtained. The schema contains 4 years of data, approximately 5 lakhs records.

**(b) Tools and Technologies:**

One of the major advantages of this dashboard is that all the tools and technologies used to build the dashboard is open source. Following are the details:

- (a) Pentaho Data Integration Tool: It comprises of a core data integration (ETL) motor and GUI applications that enable the client to characterize information combination employments and changes. The crude information extricated from various information sources are refined utilizing Pentaho.
- (b) HappyMetrix : HappyMetrix is another conspicuous device for building information examination dashboards utilizing key measurements. It offers a few prepared to-utilize information gadgets and also dashboard formats which per-mit making wonderful custom information dashboards easily. Cheerful Met-rics permits imparting information dashboards to others over the web or fare as a PDF. The apparatus has an introduction mode which empowers seeing live dashboards on an expansive show, checking key measurements and dealing with numerous dashboards.

## Technologies:

The basic technology needed to develop a website for the dashboard:

- (a) A plain HTML to create the structure of web pages.
- (b) CSS for adding styles.
- (c) Javascript to add animation and interaction in a webpage, AJAX (javascript that allows you to interact to Database without the need to refresh page).
- (d) Querying a MySQL Database
- (e) Server-side script- PHP, Python, connecting Data from database to display data in the web pages.

## (c) Framework - MVC

The proposed structure for dashboard configuration is show driven. This structure contains a few client adjustable models that can adequately catch the usefulness of a dashboard. It gives different models to demonstrating the information, the clients and their information get to benefits an

## CHAPTER 5

### RESULTS AND ANALYSIS

The proposed dashboard supports strategic administration which gives an upgraded per-spective of the execution of a projects. The refresh cycle is commonly week after week or month to month for all projects. The perspectives actualized in the dashboard is uti-lized by information investigators and arrangement creators. The diagrams are intuitive as actualized by the utilization of High Charts modules. The dashboard enables the client to penetrate down into the points of interest of the information( on the same or separate screens). The intuitive procedure includes the designs of the screen see, pop-ulating dashboard with benchmark information, distributing the dashboard for use by partners, reviving the information with new information and assessing and refining the information.

The new planned dashboard will include an incentive by

- (a) Transforming information storehouses into consumable data
- (b) Supporting visual distinguishing proof of patterns, examples, and irregularities
- (c) Guiding partners toward viable basic leadership and activity
- (d) Helping individuals think in ways that will bring about learning change
- (e) Serving as a resolute, versatile component for data stream

This outline massacres one of the principle points of a dashboard, which is to see all that we require initially. Parting the big view into a progression of little previews is commonly a misstep in dashboard plan. At the point when watchers can't see all the dashboard measures without looking over, they would be in an ideal situation perusing a printed report over a few pages, where they can be seen all at once. The dashboard is published at a predetermined revive interim. Notwithstanding, the idea of distributing

does not apply to an operational dashboard that has a 1-second (or less) revive rate. In this usage, the dashboard is constantly live. The execution lessens the time expected to make a dashboard by improving the significant dashboard plan issue: arranging numerous measures on one screen in a way that is straightforward initially. Making a dashboard report that incorporates just a single or two measures for each page improves this visual plan issue and is proper in specific circumstances. The following results demonstrate the business intelligence dashboard.

- (i) The dashboard user interface is created by mining the data generated from the log files generated by tool run. The mined data is pushed to the mysql database in different table structures, as required by the UI. The data is then queried to represent into the frontend by various scripts. The UI is generated as per user requirements. The dashboard highlights the project name (program), milestone, status and monthly reports. An optimised search bar is added to the dashboard. To find projects according to work week, date is chosen from the calendar drop-down box. This feature increases the readability of the dashboard and gives insight into project highlights in a detailed manner highlighting the business intelligence features.



Figure 5.1: UI of Dashboard

- (ii) The dashboard is designed in such a way that according to the user needs, it can be viewed with different requirements. The views include:

Parameter View - important parameters in a project(program) can be viewed.  
 Schedule View - the projects are displayed along with their time of completion.  
 Tech Indicators View - different tech indicators like power, schedule, area, performance and features for each program. Program summary View- displays program name and a view option to view a program's summary

This feature is newly added into the dashboard, earlier there were only two views. But with the user requirements and due to business decisions making more quick and enhanced, two more views are added to the dashboard.

The new views gives insight into technical indicators in a project, various early, quick, profitable decisions are made just by looking into the technical indicator report of a project instead of going through the project specification in detail.

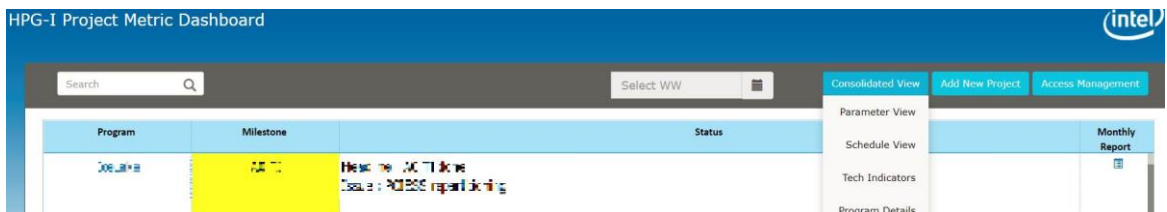


Figure 5.2: Views of dashboard

- (iii) Each project is divided into 5 different domains. This business dashboard is an integration of multiple dashboards like SOC dashboard and many more. This feature highlights use of various BI tools mention in previous chapters, how we can increase the dashboard effectiveness by integrating multiple dashboards into a single one, thus business monitoring can be done to a larger extent by a large number of access users.

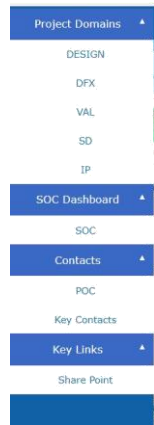


Figure 5.3: Project Domains

(iv) This report is retrieved from Headcount dashboard data source. The X-axis denotes project demands and the Y-axis denotes the no. of employees(supply). To build this following parameters are considered- Project start and end date and Total employees mapped to that project. With these, the average no. of employees month wise are obtained. It has filter option based on types of employees. Hence, this report helps in monitoring the requirements in a project.



Figure 5.4: Report of resources required in a project

(v) The figure displays another dashboard that is integrated into the main dashboard. The SOC dashboard has its own user interface to provide useful information to the re-quired audience in the organization.

It is built with different technologies and integrated with the original one. The dif-ferent options in the dashboard ui contains data from sources like JIRA, GITHUB. This highlights how a business architecture lead to success factors and prove prof-itable to the organization.

The inputs from the stakeholders with respect to the upcoming strategies of the organization is collected and displayed into this SOC dashboard.

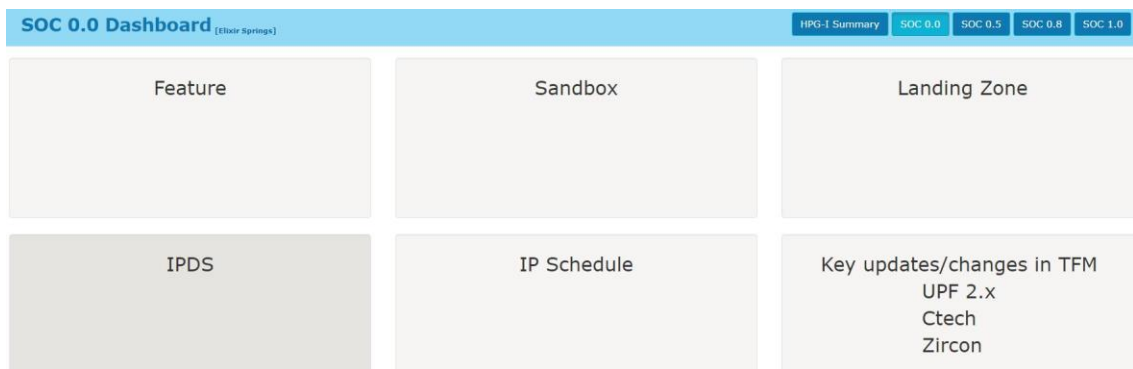


Figure 5.5: Dashboards integration

(vi) The figure displays use of Highchart which is the graphic library for our Software Analytics solution. Highcharts are used to produce the dashboard of our tool "HPG ", dedicated to the monitoring of project performance and process efficiency in software developments.

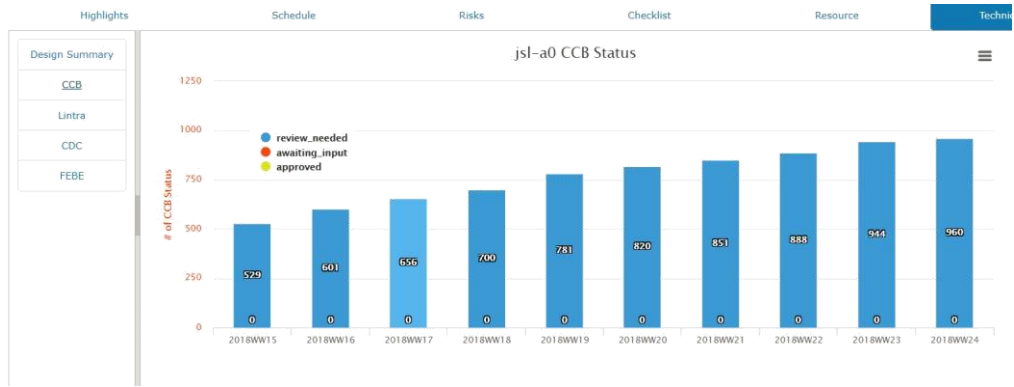


Figure 5.6: Technical indicator showing status of bugs per workweek

- (vii) The figure displays domain specific dashboards i.e. design dashboard of a project where we have the important parameters and technical indicators. The whole dashboard is editable by the user assigned to that project.

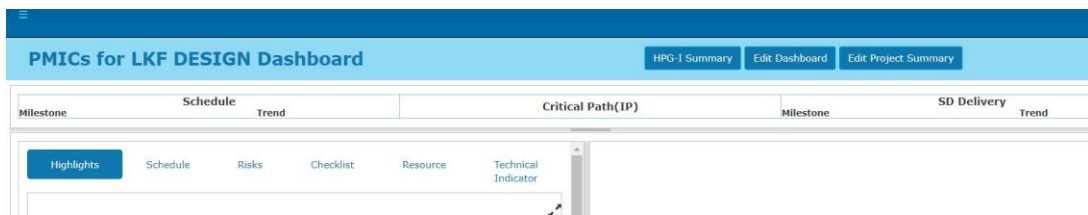


Figure 5.7: Highcharts

- (viii) It is retrieved from JIRA data source. The X-axis represents the assignee names and the Y- axis represents the number of tickets. To build it three parameters are considered -Assignee name, Issue Created Date and Issue Closed Date. By these parameters, the Average time taken by an assignee to resolve the issue is obtained. It has filter option based on team and assignee name.

This report plays an important role in monitoring the performance of each em-ployee. It gives a clear information about the amount of work done by each em-ployee. Hence, one can get to know if an employee is over working or under working. Even team wise work efforts can be retrieved from it.

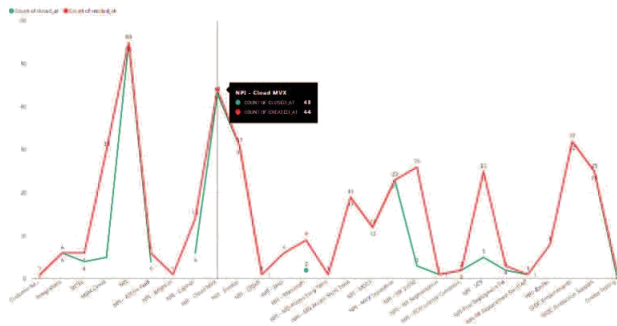


Figure 5.8: Report by Employee Performance

(ix) This report is retrieved from Zabbix data source. The X-axis represents date and the Y- axis represents the count of activities. This report provides the information about the System Uptime, System Downtime, Response time and Download availability.

Hence, it makes it easy to monitor the Health of the System. It also has an alert functionality which will send out a notification in case of any hazards like system downtime or server crash.

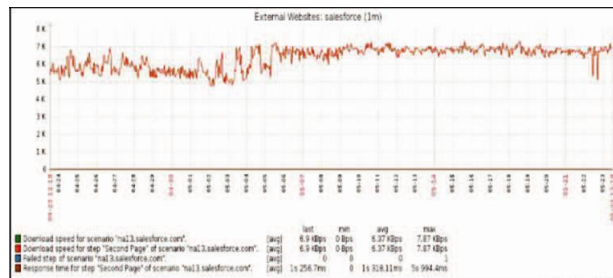


Figure 5.9: System Health Report

## CHAPTER 6

### ADVANTAGES OF PROPOSED SYSTEM

The proposed Performance Dashboard reflects the following benefits:

- (a) Enhance decision making and policy implementation.
- (b) Identify and consolidate relevant information, such as Key Performance Indicators from multiple sources.
- (c) Handling and Evaluating Dynamic data.
- (d) Implementation of various views for the single Business Intelligence Model.
- (e) Role-based views and self-service capabilities will further enhance the business processes.
- (f) Platform and device independent.
- (g) Application can act as Data Provider.
- (h) User access control and Easy login.
- (i) It is scalable and flexible.
- (j) Enforce single sourcing of data and publish it to multiple channels.
- (k) Avoids data redundancy and inaccuracy.
- (l) Its flexible to implement new metrics.

The investigation shows the fundamental attributes for dashboard that it incorporates. The highlights that are basic for progress exhibits the most vital components of a dashboard. It must be synergetic - a dashboard is ergonomically and outwardly viable for the client by synergizing the data to the single screen see. Monitoring KPIs - a dash-board must show basic KPIs that are required for the basic leadership. Utilizing an

excessive number of markers prompts the point where they can't be used efficiently.

Accurate information - analyzed data must be altogether exact with a specific end goal to get utilize's full certainty and to make certain of the information legitimacy.

Re-sponsiveness - a dashboard must react to predefined limits by indicating various types of client alarms (e.g. signals, sound cautions or messages)[1]. These will assist inspec-tor with reacting to the basic changes instantly by taking clients consideration.

Timely - the data that is inspected must be on ongoing or right-time, contingent upon the KPI what is essential. For settling on choices that are powerful and significant, a dashboard must show the most current data as would be prudent.

# CHAPTER 7

## CONCLUSION AND FUTURE SCOPE

The proposed Performance Dashboard was actualized which can give key bits of knowledge of an association through the day by day reports, report by worker and group execution, yearly or quarterly report, the normal determination time report, and considerably more in a viable and proficient way. Henceforth, the Performance Dashboard is a perfect single sheet constant UI, demonstrating a graphical introduction of the status and authentic patterns of association's key execution pointers that empower Executive choices to be made initially and enhances the business performance.

Significant favorable circumstances to the business will be refined as the Performance dashboard distinguishes the business patterns, screens the business development, the measure of benefit, track the representative execution and consumer loyalty and through Data Visualization the created reports can be effectively deciphered by the clients. Additionally, a lot of diminishment in the improvement exertion when contrasted with the conventional approaches.

We propose a proficient and powerful model-driven dashboard outline strategy. We expand the business execution displaying structure by giving various new models that empower the procedure of dashboard outline. Our model-driven approach renders the dashboard plan and sending process less tedious and less bulky. It prompts robotized code age, and permits quick and simple joining of configuration changes in the last arrangement.

We connected the proposed method for planning and conveying a dashboard for a certifiable business, and the consequences of this examination show the achievability and adequacy of our approach. We watched a huge lessening as far as required improvement time when contrasted with a more conventional dashboard arrangement process.

The dashboard can additionally be improved by including the accompanying capacities in future:

- (a) Collaboration - Agile basic leadership through interfacing with the authoritative informal organization.
- (b) Predictive - Predicting results and timing of activities through the Intensive use of situation examination, imagine a scenario in which investigation and Artificial Intelligence application.

This proposal inspected the advantages of continuous updates in data dashboards by executing a proof-of-idea framework and leading execution measurements. During the examination, it was discovered that entrance to constant updates of data are useful to programming designers, and venture supervisors in particular. It is uncovered that ongoing data in dashboards are advantageous in a few ways.

- (a) Firstly, the quick updates permits venture supervisors to construct more choices in light of information which was beforehand not available.
- (b) Secondly, venture administrators spare time by continually having the capacity to get an a la mode diagram of information from various frameworks, for example, time reports or bug trackers, without investing heaps of energy getting some information about their advance. This likewise gives the engineers a chance to center around their work.
- (c) Finally, when the dashboard is appeared on a data radiator, the moment refreshes are inspiring as observing the information change offers motivator to nish more undertakings or refresh time logs specifically after an assignment is completed.

The examine uncovered that not all data needs continuous updates and that the way information are dissected now and then requires information in settled eras[4].

## FUTURE SCOPE

The work presented in this thesis can be enhanced by implementing the following points:

- (a) Further investigation of the dashboard's execution will be done for its genuine utilization. This would give more precise information with respect to use examples and better understanding into what parts of the framework are moderate and eccentric.
- (b) Here it would likewise be alluring to direct more tests with cell phones to and how the execution contrasts between various stages. While the hidden innovation works comparatively on work areas and cell phones, the utilization situations may be tremendously extraordinary. Subsequently it is critical to see how portable customers are, or could be, utilized for expending venture data. This would give better understanding into if specific interfaces are required for these gadgets.
- (c) Not shrouded in this investigation is the way constant data can be coordinated into advancement forms. Specifically, it is important to create rules for how it ought to be resolved what data every association profits by having ongoing access to.

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