High Level Design (HLD)

Healthcare Analytics

Heart Disease Prediction

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Document Version Control

Date Issued	Version	Description	Author
2nd December 2021	1.0	First Version of Complete HLD	Ankit Kashyap
21st December 2021	1.1	Final Version with KPIs	Ankit Kashyap

Contents

Abstract

Heart disease/ **Cardiovascular disease** (**CVD**) is a class of diseases that involve the heart or blood vessels. It is a term covering any disorder of the heart. Heart diseases have become a major concern to deal with as studies show that the number of deaths due to heart diseases have increased significantly over the past few decades in India it has become the leading cause of death in India. A study shows that from 1990 to 2021 the death rate due to heart diseases have increased around 39% from 155.7 to 217 deaths per 1 lakh population in India. The underlying mechanisms vary depending on the disease. This may be caused by high blood pressure, smoking, diabetes mellitus, lack of exercise, obesity, high blood cholesterol, poor diet, excessive alcohol consumption, and poor sleep, among others.

Thus, preventing heart diseases has become more than necessary. It is estimated that up to 90% of CVD may be preventable. Good data-driven systems for predicting heart diseases can improve the entire research and prevention process, making sure that more people can live healthy lives. Detection of a CVD at an early stage leads to prevention of more than 80% of potential related deaths.

With the anecdotes of fairly and conventionally healthy people getting heart related illnesses, it is no langer an ‘old-age’ disease as previously thought and need dedicated research for prevention and potential cure.

1 Introduction

1.1 Why this High-Level Design Document?

The purpose of this High-Level Design (HLD) Document is to add the necessary detail to the current project description to represent a suitable model for coding. This document is also intended to help detect contradictions before coding and can be used as a reference manual for how the modules interact at a high level.

The HLD will be focusing on the below objectives:

- Present all the design aspects and define them in detail
- Describe the user interface being implemented
- Describe the hardware and software interfaces
- Describe the performance and requirements
- Include design features and the architecture of the project
- List and describe the non-functional attributes like:
  - Security
  - Reliability
  - Maintainability
  - Portability
  - Reusability
  - Application compatibility
  - Resource utilization
  - Serviceability

1.2 Scope

The HLD documentation presents the structure of the system, such as the database architecture, application architecture (layers), application flow (Navigation), and technology architecture. The HLD uses non-technical to mildly-technical terms which should be understandable to the administrators of the system.

2 General Description

2.1 Product Perspective & Problem Statement

The goal of this project is to analyse to predict the probability of heart disease occurrence, based on a combination of features that describes the disease. Based on the prediction we develop a BI report depicting the features affecting the occurrence of the disease and the magnitude of the affect each feature has. To achieve the goal, we used a well-defined data set that is formed by taking into consideration some of the information of 303 individuals. The problem is based on the given information about each individual we have to calculate that whether that individual will suffer from heart disease or not.

2.2 Tools used

Business Intelligence tools and libraries works such as NumPy, Pandas, Seaborn, Matplotlib, MS-Excel, MS-Power BI, Jupyter Notebook and Python Programming Language are used to build the whole framework

- Jupyter Notebbok is used as IDE.
- Python is the Programming Language used
- EDA is done using Numpy & Pandas
- Model Development is done using skikit learn
- Visualization were done using seaborn.
- Power BI is used for dashboard creation.

2.3 Constraints

Our analysis is done based on a limited dataset provided for a specific (14) features affecting heart disease. The analysis does not take into account any external interventions like underlying disease, type of medication used, lifestyle patterns, BMI value e.t.c.

2.4 Assumptions

It is a task that is trivially performed by doctors, however the use of past cases and the potential cause for such cases has enabled data analysts to create a segment of symptoms/causes belonging to which significantly increases a risk of a potential heart disease in the future.

Our analysis assumes that all the data provided was true without any corruption and the features mentioned in the raw dataset are the only driving factors of a potential heart disease.

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3 Design Details

3.1 Functional Architecture

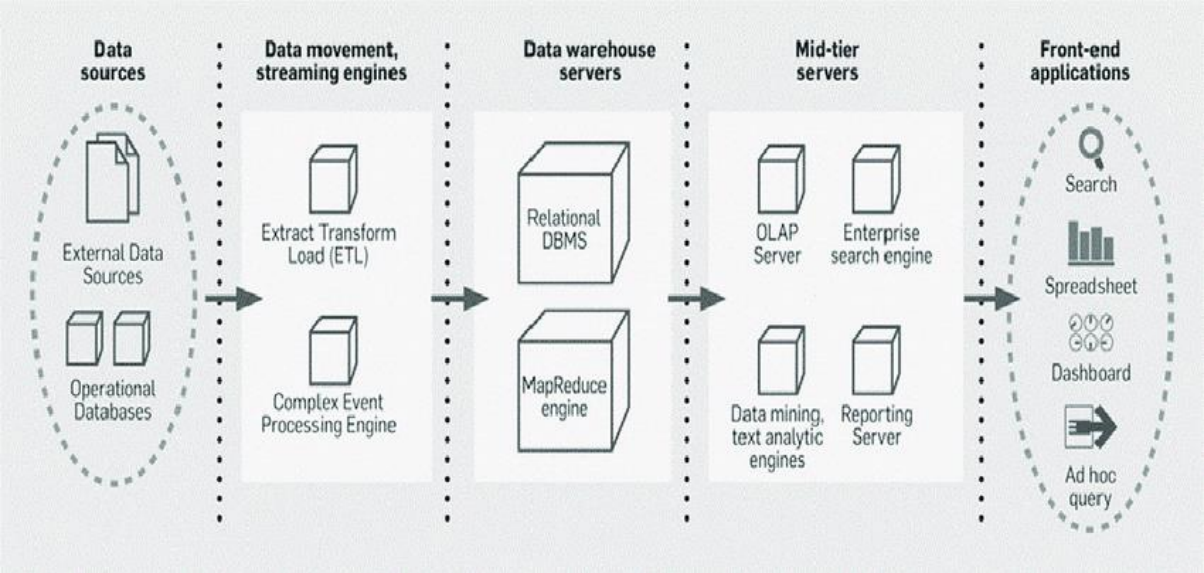


Figure 1: Functional Architecture of Business Intelligence

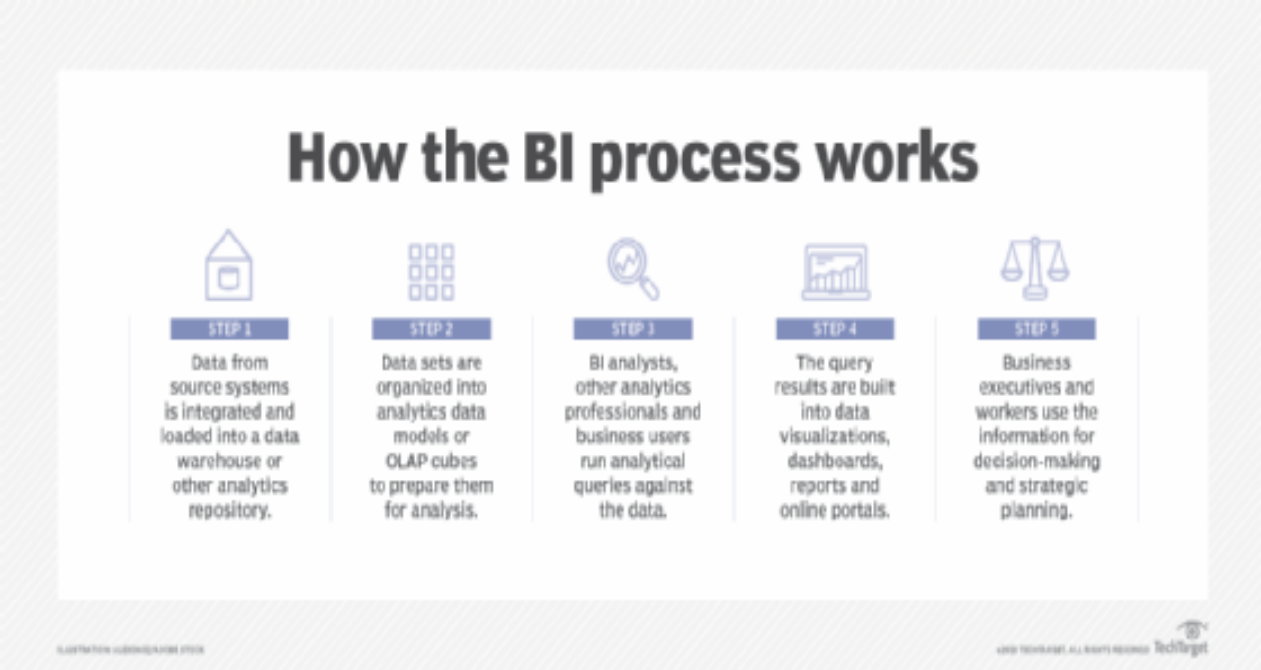


Figure 2: Working of BI process

3.2 BI Reporting Architecture

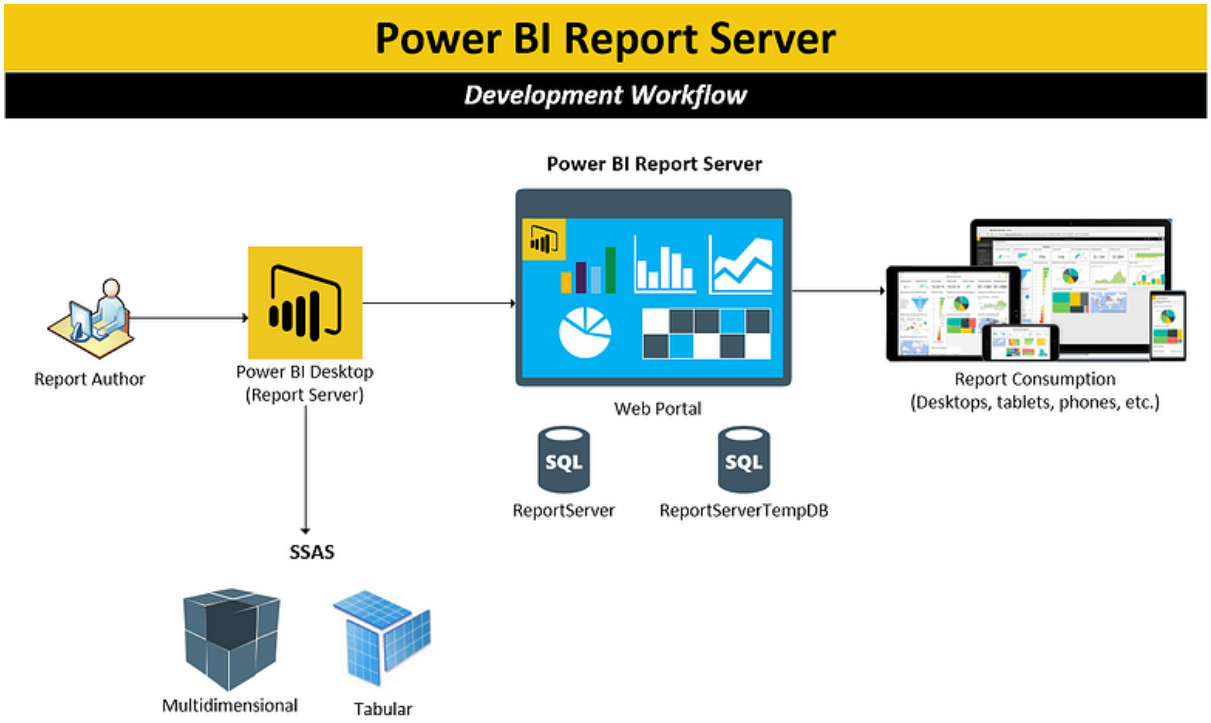


Figure 2: BI Reporting architecture

3.3 Optimization

1. **Your data strategy drives performance**
   - Minimize the number of fields
   - Minimize the number of records
   - Optimize extracts to speed up future queries by materializing calculations, removing columns and the use of accelerated views

2. **Reduce the marks (data points) in your view**
   - Practice guided analytics. There's no need to fit everything you plan to show in a single view. Compile related views and connect them with action filters to travel from overview to highly-granular views at the speed of thought.

- Remove unneeded dimensions from the detail shelf.
- Explore. Try displaying your data in different types of views.

3. **Limit your filters by number and type**

- Reduce the number of filters in use. Excessive filters on a view will create a more complex query, which takes longer to return results. Double-check your filters and remove any that aren't necessary.

- Use an include filter. Exclude filters load the entire domain of a dimension while including filters do not. An include filter runs much faster than an exclude filter, especially for dimensions with many members.

- Use a continuous date filter. Continuous date filters (relative and range-of- date filters) can take advantage of the indexing properties in your database and are faster than discrete data filters.

- Use Boolean or numeric filters. Computers process integers and Booleans (t/f) much faster than strings.

- Use parameters and action filters. These reduce the query load (and work across data sources).

3.4 Performance

Healthcare analytics determines the presence or absence of a life threatening condition, it should be as accurate as possible. So that it will not mislead the user. Also, model retraining is very important to improve the performance.

3.5 Security

Since the Health care analysis consists of patient's data, the information should be secured.

3.6 Reusability

The code written and the components used should have the ability to be reused with no problems.

3.7 Resource utilization

When any task is performed, it will likely use all the processing power available until that function is finished.

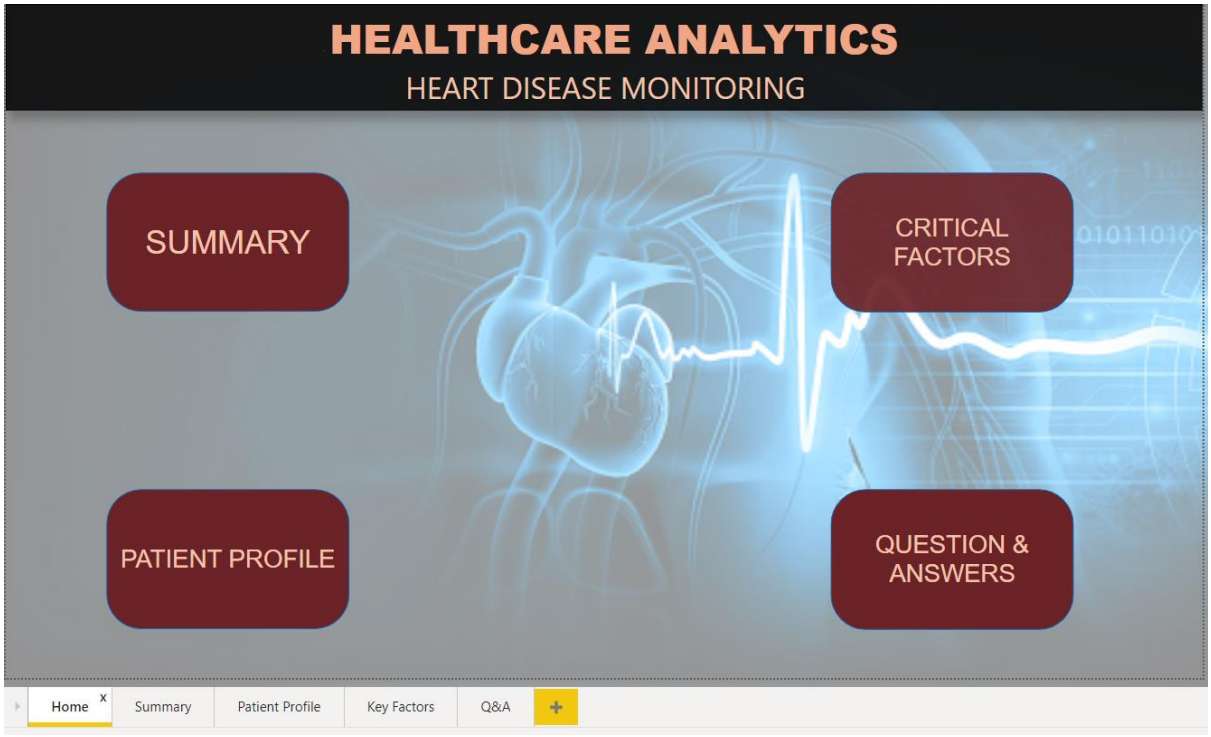
3.8 Deployment

Power BI prioritizes choice in flexibility to fit, rather than dictate, your enterprise architecture. Power BI Desktop and Power BI Service leverage your existing technology investments and integrate them into your IT infrastructure to provide a self-service, modern analytics platform for your users. With on-premises, cloud, and hosted options, there is a version of Power BI to match your requirements.

4 Dashboards

Dashboards will be implemented to display and indicate certain KPIs and relevant indicators for the presence of heart disease.

The final dashboard will contain the following key visuals:



The Dashboard is published on Power BI service and an auto-refresh mode has been set so that the dashboard keeps on updating as the real time data loads into the log file.

The Dashboard showcases the multiple insights that has been drawn from the log files as follows:

1. **Summary:** The dashboard contains the statistical summary of the dataset and the visual displaying the effect of different feature to heart disease.

2. **Critical Factors:** This dashboard picks out the most important feature resulting in the presence of a heart disease and the magnitude at which it affects the presence.

3. **Patient Profile:** This dashboard shows the profile of a patient that has a disease displaying the average age, BP level e.t.c.

4. **Question & Answers:** This is a NLP enabled visual that allows end user to quickly create visuals based on the required specification.

4.1 KPIs (Key Performance Indicators)

Key indicators displaying a summary of the Housing Price and its relationship with different metrics

1. Percentage of People Having Heart Disease
2. Age Distribution including Gender
3. Gender Distribution Based on Heart Disease
4. Chest Pain Experienced by People Suffering from Heart Disease
5. Blood Pressure, Cholesterol Level and Maximum Heart Rate of People According to their Age and Heart Disease Patients.
6. ST Depression Experienced by People According to their age and heart disease.

5 References

1. Google Search