

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY**  
**Jnana Sangama, Belagavi-590018**



INTERNSHIP REPORT

ON

**"Data Visualization using Knowage platform"**

Submitted in partial fulfillment of the requirements for the award of degree of

**BACHELOR OF ENGINEERING**  
**in**  
**COMPUTER SCIENCE AND ENGINEERING**

For the Academic Year 2018-19

Submitted by:

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(1MV18CS020)

Internship carried out at

**BEL**

**BANGALORE**

**Under the guidance of:**

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**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING**

**SIR M. VISVESVARAYA INSTITUTE OF TECHNOLOGY**

**HUNASAMARANAHALLI, BENGALURU - 562157**

## DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING



### CERTIFICATE

It is certified that the Internship work entitled "**Data Visualization using Knowledge platform**" is a bonafide work carried out by **BRINDA KAUSHIK B A (1MV18CS020)** in partial fulfillment for the award of the Degree of Bachelor of Engineering in Computer Science and Engineering of the Visvesvaraya Technological University, Belagavi during the year 2020-21. It is certified that all corrections and suggestions indicated for Internal Assessment have been incorporated in the report. The report has been approved as it satisfies the academic requirements in respect of Internship work prescribed for the course of Bachelor of Engineering.

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External Examination:

Name of the Examiners

- 1)
- 2)

Signature with date

## CENTRE FOR LEARNING AND DEVELOPMENT

BHARAT ELECTRONICS LIMITED  
(A Govt. of India Enterprise, Ministry of Defence)  
Jalahalli Post, Bengaluru - 560 013, India

### Certificate

*This is to certify that*

*Sri./Smt./Kum .* **BRINDA KAUSHIK. BA.** .....

*Ref No. .* **1410/CLD/HR/2021-22/27/123.** .....

*student of .* **SIR M. VISVESVARAYA INSTITUTE OF** ....  
**TECHNOLOGY, BENGALURU** .....

*carried out Project Work/Internship on .* **DATA** .....

**VISUALIZATION USING KNOWAGE PLATFORM** .....

*in .* **SOFTWARE** .....

*SBU/CSG of BEL, Bengaluru from .* **01<sup>ST</sup> SEPTEMBER 2021**  
*to .* **30<sup>TH</sup> SEPTEMBER 2021.**

*He/She was regular and punctual in his/her attendance  
and his/her conduct was satisfactory during the period.*

  
**Project / Internship Guide**

**Date : 30.09.2021**

**Place : Bengaluru**

  
**Head (HR/CLD)**

## ACKNOWLEDGMENT

I cannot express enough of my sincere gratitude to **Mrs. Shobha Rani G**, of BEL, Bangalore for providing me the opportunity and the resources to work under them on their company's project and for providing me their invaluable help when I found myself in a spot of bother.

This internship consumed a huge amount of work, research and dedication. Still, implementation would not have been possible if I did not have the support of many individuals. Therefore, I would like to extend my sincere gratitude to all of them. First of all, I am thankful to my **Principal Dr. V R Manjunath** for providing me with all the necessary permissions to work on the internship.

I am also grateful to **Dr. G. C. Bhanu Prakash**, Head of Department, Computer Science and Engineering, for provision of expertise, and logistical support during the course of the internship.

I would also like to thank **Dr.**, Assistant Prof., Computer Science and Engineering for always being there to clarify my queries and give me valuable suggestions.

Nevertheless, I express my gratitude towards my family and friends for their kind cooperation and encouragement which helped me in the completion of this internship successfully.

## **ABSTRACT**

Data visualization is the practice of translating information into a visual context, such as a map or graph, to make data easier for the human brain to understand and pull insights from. The main goal of data visualization is to make it easier to identify patterns, trends and outliers in large data sets. The term is often used interchangeably with others, including information graphics, information visualization and statistical graphics.

Data visualization is one of the steps of data science process, which states that after data has been collected, processed and modelled, it must be visualized for conclusions to be made. Data visualization is also an element of the broader data presentation architecture (DPA) discipline, which aims to identify, locate, manipulate, format and deliver data in the most efficient way possible.

Data visualization is important for almost every career. It can be used by teachers to display student test results, by computer scientists exploring advancements in Artificial Intelligence (AI) or by executives looking to share information with stakeholders. It also plays an important role in big data projects. As businesses accumulated massive collections of data during the early years of the big data trend, they needed a way to quickly and easily get an overview of their data. Visualization tools were a natural fit.

This report explains in detail the work done as an intern under BEL in the domain of Data Visualization.

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## CHAPTER 1

### INTRODUCTION

**KNOWAGE** is the most comprehensive open source analytics and business intelligence suite, it satisfies traditional requirements as well as innovative and challenging informative domains. It is based on an open source model, perfectly combining the innovation coming from the communities with the experience and practices of the enterprise-level solutions.

KNOWAGE allows you to combine traditional data and big data sources into valuable and meaningful information. A full set of features, such as data exploration, data preparation, self-service data, ad-hoc reporting, mash-up, data/text mining embedding and advanced data visualization, give special focus on big data / cloud data sources and augmented analytics.





KNOWAGE complies the criteria of modern BI, giving high customization capabilities and high autonomy to the end user, always in a secure and well managed environment, fully supporting the bi-modal approach where fast development meets enterprise requirements such as data consistency and reliability.

Thanks to the open source model and adoption of open standards, KNOWAGE can be used as-is or easily included in a third-part application giving it new value with embedded analytics.

KNOWAGE provides a lot of functionalities such as: static reporting, OLAP engine for multidimensional analysis, what-if models, interactive dashboards, ad-hoc reporting, KPI definition and monitoring, visual data exploration, spatial/geographic views, flat data entry, Office integration, collaborative tools, automatic dossier, personal workspace, upload file for new personal data and self-service capabilities, data preparation and more.





## CHAPTER 2

### COMPANY PROFILE

BHARAT ELECTRONICS LIMITED(BEL) is an Indian Government-owned aerospace and defence electronics company. It primarily manufactures advanced electronic products for ground and aerospace applications. BEL is one of nine PSUs under the Ministry of Defence of India. It has been granted Navratna status by the Government of India.



It was founded in Bengaluru, Karnataka, India in 1954. Starting with the manufacture of a few communication equipment in 1956, BEL started producing receiving valves in 1961, germanium semiconductors in 1962 and radio transmitters for AIR in 1964 with the help of Soviet Union.

BEL designs, develops and manufactures a range of products in the following fields:

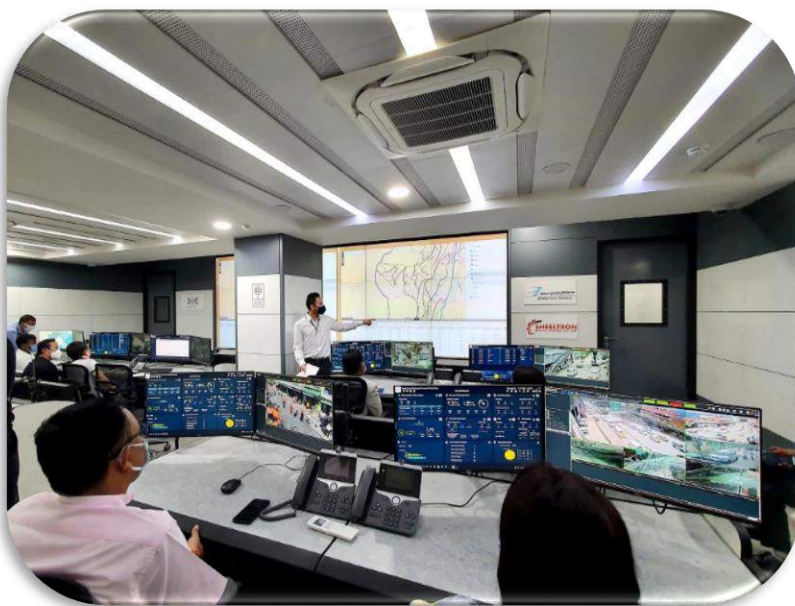
- 1) Electronic voting machines
- 2) Voter-verified paper audit trail
- 3) Traffic signals
- 4) Radars
- 5) Telecommunications
- 6) Sound and vision broadcasting
- 7) Opto-electronics
- 6) Information technology
- 7) Semiconductors
- 8) Missiles
- 9) Sonars
- 10) Composite Communication System (CCS)
- 11) Fire-control system
- 12) Radar
- 13) Electronic warfare systems
- 14) Tank electronics
- 15) Defence Communications and many more.

## SUBSIDIARIES AND JOINT VENTURES:

1) Bharat Electronics Limited has set up a joint venture with General Electric (GE) USA, for manufacturing high voltage tanks and detector modules for computed tomography (CT) scan systems and advanced level of X-ray tubes. The company is in the process of joining with Bharat Heavy Electricals Limited (BHEL) to set up a joint venture to make solar photovoltaic components. BEL has signed a memorandum of understanding with Indus Teqsite, Chennai, for the design and development of digital subsystems for its equipment, test systems for its radars, avionics and electronic warfare, and another with the French company Thales International to set up a joint venture for civilian and defence radar. BEL has signed a memorandum of understanding with Textron systems.

2) BEL Optronics Devices Ltd. is a subsidiary company of BEL. It was founded in 1990 with the aim of conducting research, development and manufacture of image intensifier tubes and associated high voltage power supply units for use in military, security and commercial systems. The company is headquartered in Pune and earned aggregated revenue of ₹516 million (US\$6.9 million) during the fiscal year 2007.

3) BEL-Thales Systems Limited is a joint venture company (JVC) between Bharat Electronics Limited and Thales. Incorporated on 28 August 2014, the company is located in the BEL Industrial Estate, Jalahalli, Bengaluru.



4) GE-BE Pvt Limited was set up in 1997 as a joint venture between Bharat Electronics Limited and General Electric Medical System. The facility based at Whitefield, Bangalore, manufactures X-ray tubes for RAD & F and CT systems, as well as components such as high voltage tanks and detector modules for CT systems. The products are exported worldwide and meet the safety and regulatory standards specified by FDA, CE, MHW, AERB and the facility has been accredited with ISO-9001; ISO-13485 and ISO-14001 certifications. GE-BEL also markets the conventional X-ray tubes made at the Pune unit of BEL. The turnover of GE-BEL during 2004–2005 was over ₹4.50 billion (US\$97 million) including an export of over ₹4.30 billion (US\$92 million). The company has been recognised for its outstanding export performance since 1998 by the Export Promotion Councils.



## **CHAPTER 3**

### **ABOUT THE COMPANY**

In 1980, the first overseas office of BEL was set up in New York for the procurement of components and materials.

In 1981, a manufacturing facility for magnesium manganese dioxide batteries was set up at Pune. The Space Electronic Division was set up at Bangalore to support the satellite programmes in 1982. That year, BEL achieved a turnover of ₹1 billion (US\$21 million).

In 1983, the Andhra Scientific Company (ASCO) was taken over by BEL converted it to its fourth manufacturing unit at Machilipatnam.

In 1985, the fifth unit was set up in Chennai for supply of tank electronics, with proximity to Heavy Vehicles Factory, Chennai of the Ordnance Factory Board. The sixth unit was set up at Panchkula the same year to manufacture military communication equipment.

In 1986, BEL set up three units. Its seventh unit was set up at Kotdwara to manufacture switching equipment, the eighth unit to manufacture TV glass shell at Taloja (Navi Mumbai) and the ninth unit at Hyderabad to manufacture electronic warfare equipment.

In 1987, a separate Naval Equipment Division was set up at Bangalore to give greater focus to naval projects. The first Central Research Laboratory was established at Bangalore in 1988 to focus on futuristic research and development.

In 1989, BEL started manufacturing telecom switching and transmission systems and also the set up the Mass Manufacturing Facility in Bangalore and the manufacture of the first batch of 75,000 electronic voting machines.

The agreement for setting up BEL's first joint venture company, BE DELFT, with M/s Delft of Holland, was signed in 1990. This later became a subsidiary of BEL with the exit of the foreign partner and has been renamed BEL Optronics Devices Limited.

The second Central Research Laboratory was established at Ghaziabad in 1992. The first disinvestment (20%) and listing of the company's shares in the Bangalore and Mumbai Stock Exchanges took place in same year-1992.

In 1996, BEL achieved ₹10 billion (US\$215 million) turnover.

In 1997, GE BEL, the second joint venture company with M/s GE, USA, was formed as also the third JVC with M/s Multitone, UK, BEL Multitone. The same year, the US imposed supply restrictions on BEL.

In 1998, BEL set up its second overseas office at Singapore to source components from South East Asia. In the same year US and Europe imposed sanctions on BEL. The company was able to overcome the effects of the sanctions and kept up the promised deliveries to customers.

In 2000, BEL reorganised its Bangalore unit into six Strategic Business Units (SBUs). The R&D groups in Bangalore were also restructured into Specific Core Groups and Product Development Groups. The same year, BEL shares were listed in the National Stock Exchange.

In 2002, BEL became the first defence PSU to achieve operational Mini Ratna Category I status. In 2003, the company's turnover crossed the ₹25 billion mark (US\$540 million). In 2005, BEL had a turnover of ₹32.20 billion (US\$695 million). BEL achieved a turnover of ₹35.60 billion (US\$767 million) in 2005–06.

On 12 May 2010, Boeing announced that it received the Data Link II communications technology for the Indian Navy's P-8I from Bharat Electronics Limited (BEL) in April, one month ahead of schedule. BEL delivered the Indian-designed communications system that would enable the exchange of tactical data and messages between Indian Navy aircraft, ships and shore establishments. Boeing installed the system during final assembly of P-8I.

In 2011, the Indian government-owned Bharat Electronic Limited (BEL) showcased its entire range of C4ISR capabilities including network centric warfare technologies developed in-house at Aero India 2011.

These include command and control system, air space management multi sensor tracking, situation simulator and tactical algorithm for air defence applications; battlefield management system and an all-weather 24/7 coastal surveillance system.

In 2019, the Indian government-owned Bharat Electronic Limited (BEL) was awarded the tender to implement the project "Integrated Command and Control Centre" for Gangtok Smart City under Smart Cities Mission initiated by the Ministry of Housing & Urban Affairs, Government of India.

In addition, new products and technologies including software defined radios, next generation bulk encryptor and high data tactical radio were also on show. Airborne products displayed included radar finger printing system, data link, digital flight control computer and identification friend or foe. Also on display were the complete range of optoelectronic equipment, including night vision devices, digital handheld compass and an advanced land navigation system.

BEL is the lead integrator of Akash, the Indian-made guided missile air defence weapon system.<sup>[9]</sup> Another major system is weapon locating radar, the state-of-the-art passive, phased array radar which has undergone successful user trials by the Indian defence forces.





Because of the way the human brain processes information, using charts or graphs to visualize large amounts of complex data is easier than poring over spreadsheets or reports. Data visualization is a quick, easy way to convey concepts in a universal manner – and you can experiment with different scenarios by making slight adjustments.

Data visualization can also:

- Identify areas that need attention or improvement.
- Clarify which factors influence customer behavior.
- Help you understand which products to place where.
- Predict sales volumes.

Before implementing new technology, there are some steps you need to take. Not only do you need to have a solid grasp on your data, you also need to understand your goals, needs and audience. Preparing your organization for data visualization technology requires that you first:

- Understand the data you're trying to visualize, including its size and cardinality (the uniqueness of data values in a column).
- Determine what you're trying to visualize and what kind of information you want to communicate.
- Know your audience and understand how it processes visual information.
- Use a visual that conveys the information in the best and simplest form for your audience.

Once answered those initial questions about the type of data you have and the audience who'll be consuming the information, you need to prepare for the amount of data you'll be working with. Big data brings new challenges to visualization because large volumes, different varieties and varying velocities must be taken into account. Plus, data is often generated faster.

**KNOWAGE:**

KNOWAGE is the open source analytics and business intelligence suite that allows you to combine traditional data and big cloud data sources into valuable and meaningful information. Its features, such as data federation, mash-up, data/text mining and advanced data visualization, give comprehensive support to rich and multi-source data analysis. The suite is composed of two main modules and four additional plugins that can be combined to ensure full coverage of user requirements.



NAME	DESCRIPTION
SMART INTELLIGENCE	The usual business intelligence on structured data, but more oriented to self-service capabilities and agile prototyping.
ENTERPRISE REPORTING	To produce and distribute static reports.
LOCATION INTELLIGENCE	To relate business data with spatial or geographical information.
PERFORMANCE MANAGEMENT	To manage KPIs and organize scorecards, to monitor your business in real-time.
CUSTOM ANALYTICS	To add what-if capabilities to take full advantage of R/python embedding possibilities
SMART DATA	To combine Solr index with other data sources and provide faceted views and full text search.

## COCKPIT:

Knowage allow end users to *self-build interactive cockpits* through an intuitive and interactive interface, with a few clicks and simple drag and drop. This allows you to compose your analytical documents with multiple widgets and define associations among them, so that clicking on one widget data are automatically updated in other widgets.

It enables *data mash-up* to integrate enterprise data and externally sourced data.

Cockpit documents can be created and executed both by technical users and end users and are part of Knowage ad-hoc reporting system. A key aspect is that different widget can rely on different datasets and hence on different data sources. The only requirement needed to define associations between two or more datasets is the presence in each of them of one or more columns containing the same data.

To let all the BI tools work properly you need to configure DB connection. There are two different options available for the configuration **JNDI** (recommended) and **JDBC**.

### Connect to your data

In order to connect to your data, you have to define a new data source connection.

Knowage manages two types of data source connections:

- connections retrieved as JNDI resources, which are managed by the application server on which Knowage is working. This allows the application server to optimize data access (e.g. by defining connection pools) and thus are the preferred ones. Here you can find information how create connection pool in Tomcat : <https://tomcat.apache.org/tomcat-8.0-doc/jndi-datasource-examples-howto.html>
- direct JDBC connections, which are directly managed by Knowage;

To add a new connection, first add the relative JDBC driver to the folder `TOMCAT_HOME/lib` and restart Knowage. Then, login as administrator (user: *biadmin*, password: *biadmin* are the default credential) and select the **Data source** item from the **Data provider** panel in the administrator menu.

The end user can access data in different ways. He can exploit datasets shared by technical users (those datasets are typically querying enterprise data sources) or CKAN resources, upload his own data or query the metamodels (also created and shared by the technical users) using QbE.

Once data are linked into Knowage and dataset are created it is time to create the data visualizations. The Knowage tool for easily reaching this goal and create dashboards is the cockpit engine: it is providing a user-friendly designer where the user selects one or more datasets and uses them to create interactive visualizations, that we call “cockpits”. A key aspect is that cockpit and its graphical elements, called widgets, can rely on different datasets of different types at the same time with no differences from the user perspective: this means that it doesn’t matter where the datasets are coming from, if the final user created them by his own or if they were created and shared by technical people. Another key aspect is that data coming from different sources can be used simultaneously in the same cockpit.

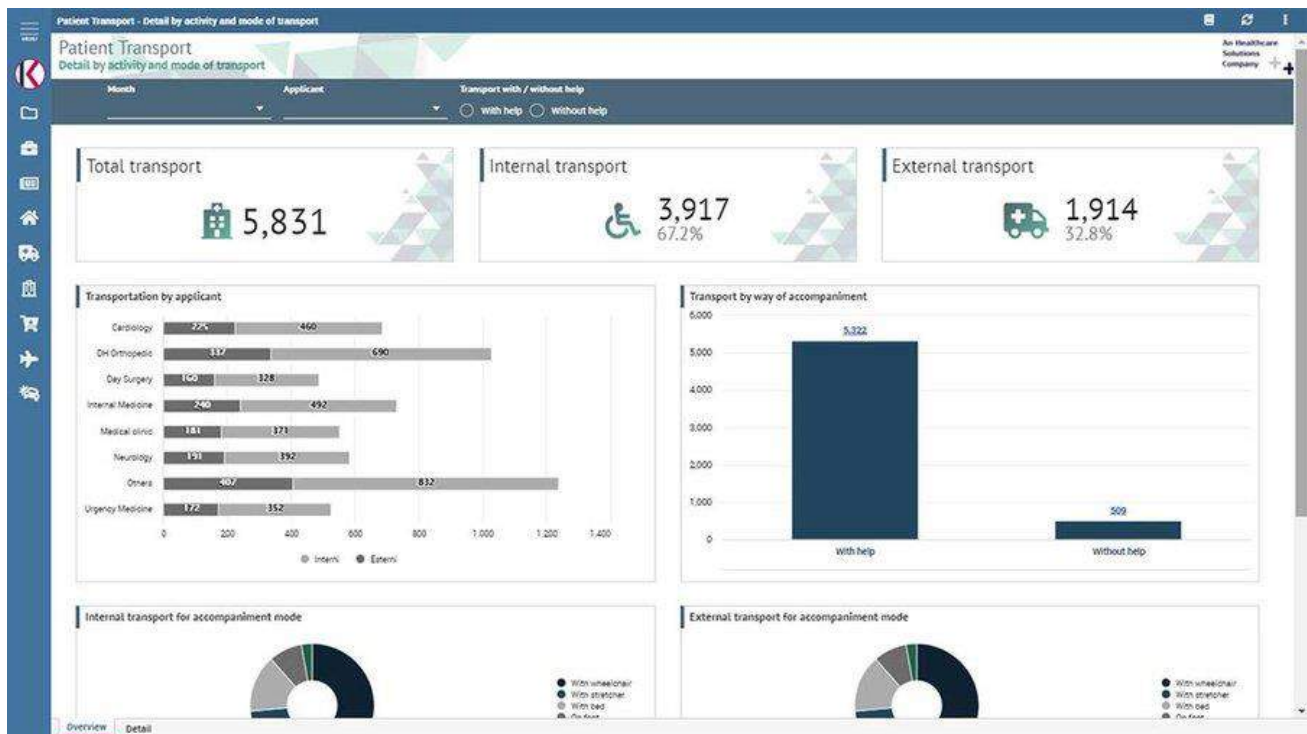
## Observation of various cockpits created:

1.



## Air Traffic monitoring

2.

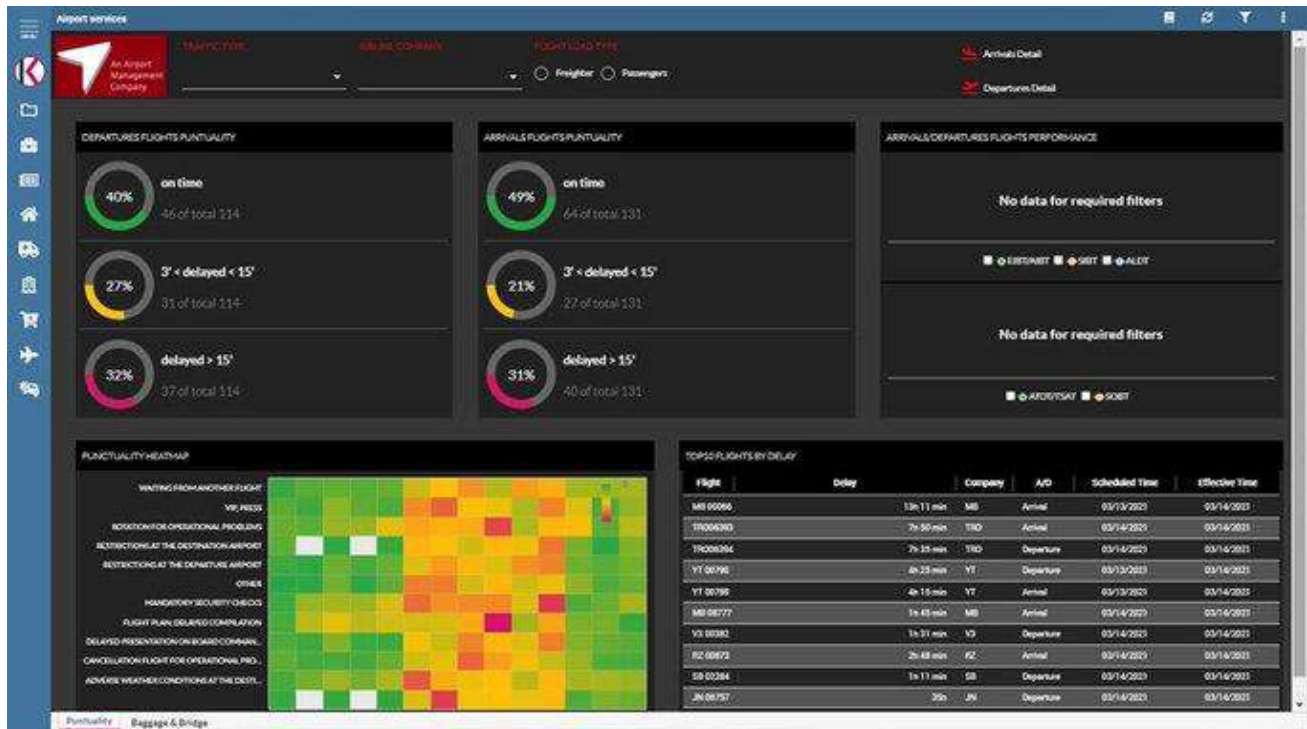


## Healthcare sector

This dashboard allows to monitor:

- Patients transport from different wards
- Accompaniment mode and transport type
- Transports distribution over time
- Incidence of transport modes on wards

3.



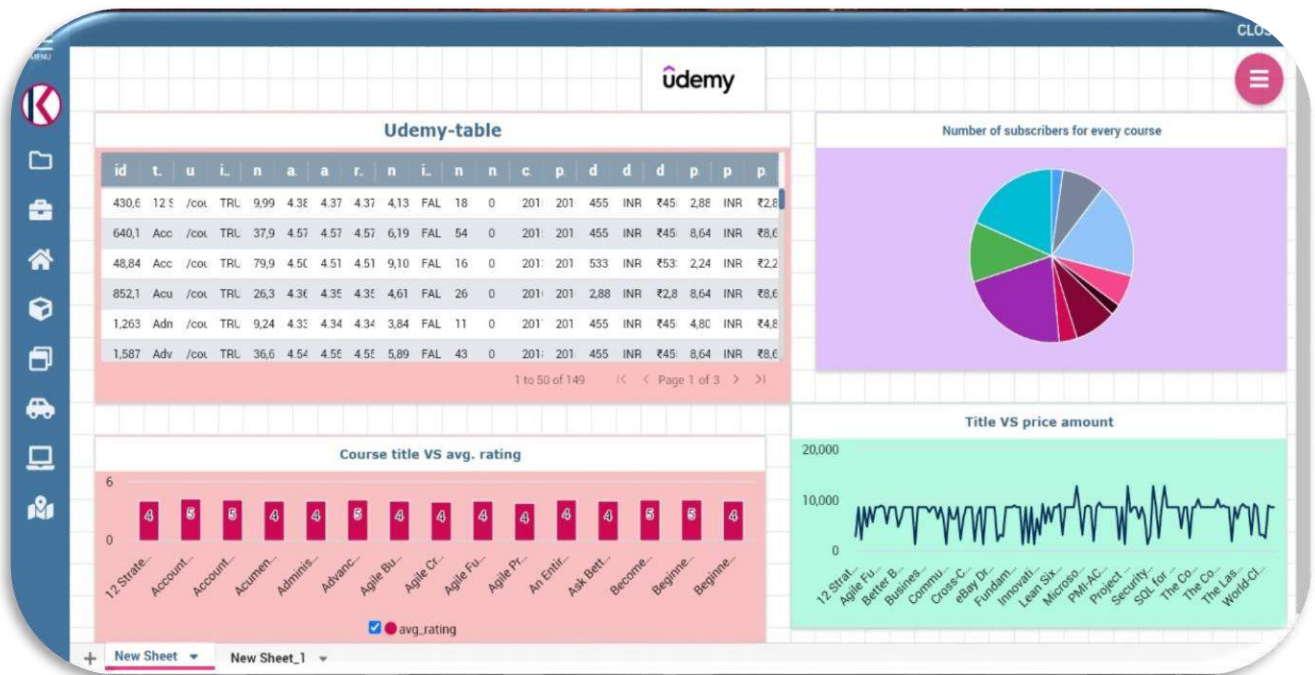
## AIR TRANSPORT

This dashboard allows to monitor:

- Departure/arrival flights punctuality
- Flights performances
- Baggage claim and loading bridge

Data can be filtered by traffic type, airline company ,flight load type.

4.



## UDEMY COURSES

This is the dashboard that monitors the following:

- Number of students for every course
- Compare Title of course along with price amount
- The complete Udemy-table
- The rating of courses given by the students for the respective courses.



## **CHAPTER 5**

### **REFLECTION**

- During my work as Intern at BEL, I was fortunate enough to have experienced first-hand and learned many different sides of how to do Data Visualization.
- I learnt more basics of visualization and big data. This helped me to understand the concepts properly.
- It was indeed a great experience working as an intern in Bharat Electronics Limited.

## **CHAPTER 6**

### **CONCLUSION**

The internship helped me understand the difficulties involved with data visualization and business analytics using knowage, and has also spiked my interest in this field . The problem statements in the internship dealt with a couple of common problems and helped me gain invaluable insights into the concepts of business analytics.

The professional environment, combined with the valuable guidance of my mentors, I have discovered the path towards becoming a better developer, analyzer and problem solver. I will take all these lessons with me on my professional journey, and hope to improve with every passing day.