NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA, SURATHKAL

A PROJECT REPORT ON

"Implementation of RBAC in Analytical Dashboard"

Submitted in partial fulfillment of the requirements for the degree of

M. TECH(RESEARCH) IN
COMPUTER SCIENCE & ENGINEERING / COMPUTER SCIENCE & ENGINEERING-INFORMATION SECURITY

Submitted By:

GAGAN N -   203IS001
GOWTHAM L -   203CS001

UNDER THE GUIDANCE OF

Prof. Mahindra Pratap Singh

Assistant Professor

Department of CSE,

NITK, Surathkal

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA
SURATHKAL
2020-21

TABLE OF CONTENTS

ABSTRACT

Role-based access control (RBAC) restricts access based on a person's role within an organization and has become one of the main methods for advanced access control. The roles in RBAC refer to the levels of access that employees have in the organization. Employees are only allowed to access the information necessary to effectively perform their job duties. Access can be based on several factors, such as authority, responsibility, and job competency. In addition, access to data can be limited to specific tasks. As a result, lower-level employees usually do not have access to sensitive data if they do not need it to fulfill their responsibilities. This is especially helpful if you have many employees and use third-parties and contractors that make it difficult to closely monitor data access. Using RBAC will help in securing the organization sensitive data

INTRODUCTION OF APPLICATION

In present world general data flow for any analytical dashboard is shown in Fig 1, we have mimicked the same flow in our dashboard, Raw layer will contain the raw data collected from the transactional system, Curated Layer or the analytical layer will have the transformed data which is suitable for analytics

Scope of our project is to take data from the raw layer and do transformations on the raw data and store it in the curated layer or analytical layer, which will be input for the Dashboard, Dashboard will display the charts and tables based on user's role using Role-based access control (RBAC).

Role-based access control (RBAC) is a method of restricting access based on the roles of individual users within an organization. RBAC lets employees have access rights only to the information they need to do their jobs and prevents them from accessing information that doesn't pertain to them.

An employee's role in an organization determines the permissions that individual is granted and ensures that lower-level employees can't access sensitive information
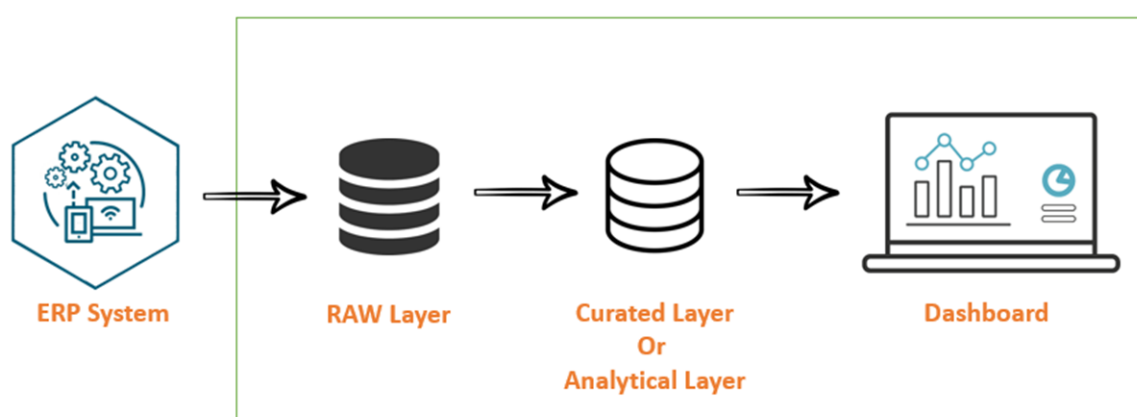

Fig 1: Typical data flow for the analytical dashboard

IMPLEMENTATION

We have implemented the project using below mentioned technologies

- PostgreSQL for data base,
- Python Flask framework for Server
- HTML, CSS and JavaScript for frontend.

When the user login to the website first authentication function will check his login id and password credentials provided on login page if it matches, then his login ID will be passed on to authorization function. Authorization function will then check what roles the user ID has access to, through those roles what are the permission the user has and will send them to display function. Display function will query the data base and fetch only the required rows to which the user is having access to and will pass context values to html file.

In the database we have created 3 schemas

1. sales_raw
2. sales _anl
3. rbac

sales_raw schema contains only raw data which we got from Kaggle and it has below columns.

- sales_representative
- location
- region
- customer
- order_date
- item
- quantity
- price

sales_anl schema will take data from the sales_raw schema as its source and transformations are done on that data and below are the tables/views and columns.

1. sales_by_location
    - location
    - total_sale_amount
2. srv_total_sales_by_month
    - month
    - total_sale_amount

rbac schema contains tables/views related to implementation of RBAC, below are the tables/views in rbac schema, Fig2 shows the schema diagram for RBAC implementation

1. role
2. role_hierarchy
3. permission
4. permission_role_assignment
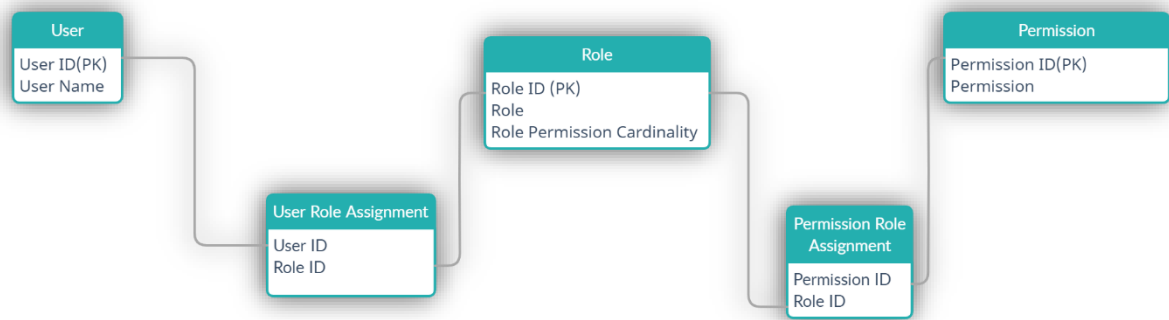5. users
6. user_role_assignment

Fig2: Schema diagram for RBAC implementation

The Organization has 3 levels as shown In Fig 3

- Director
- Manager
- Sales Representative

The sales representative will have access to only his customers sale data, he will not be able to view other sales representative's sale information.

Manager will have access to only his subordinates, he cannot view other sales representative's data.

Director is the super user who will have access to complete data in his organization.

In our project we have considered 3 roles sales representative, manager and director

- 5 sales representatives
  o Frances Warren
  o Randy Watson
  o Patrick Graham
  o Sara Snyder
  o Diane Gonzalez

- 2 Managers
  - Gagan
  - Gowtham
- 1 Director
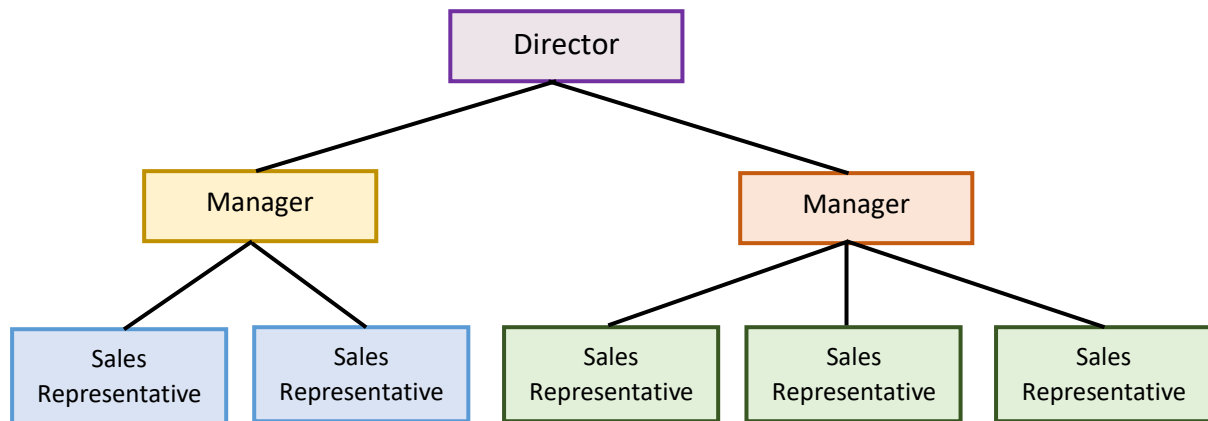 - Raj Kumar

Fig 3: Organization Structure

We can designate whether the user is a sales representative, manager or director and align roles and access permissions with the employee's positions in the organization. Permissions are allocated only with enough access as needed for employees to do their jobs. if an end-user's job changes, we may need to manually assign their role to another user

FLOW DIAGRAM

Fig 4: Flow diagram of project
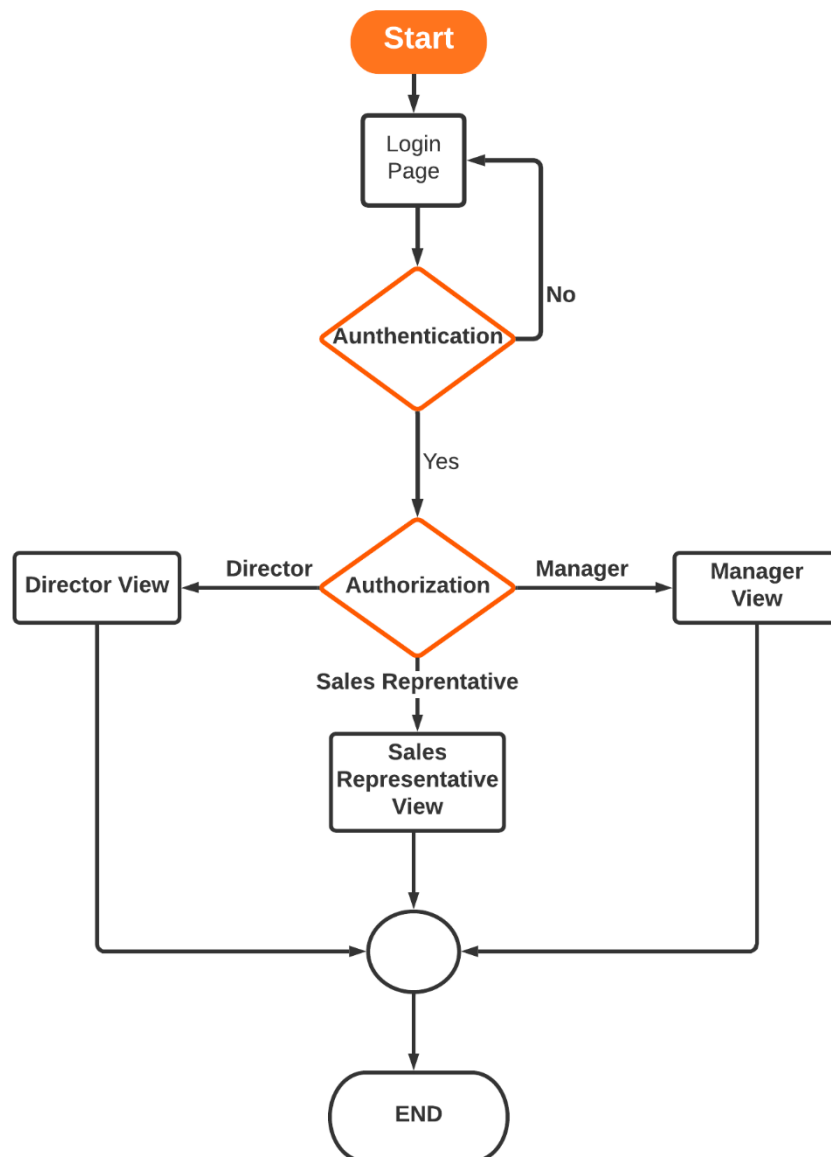
When the user login to the website first authentication system check his login id and password credentials if it matches, then his login ID will be sent to authorization system. Authorization system will then check what roles the user ID has access to, through those roles what are the permission the user has and will display only that data which he has permissions on the dashboard.
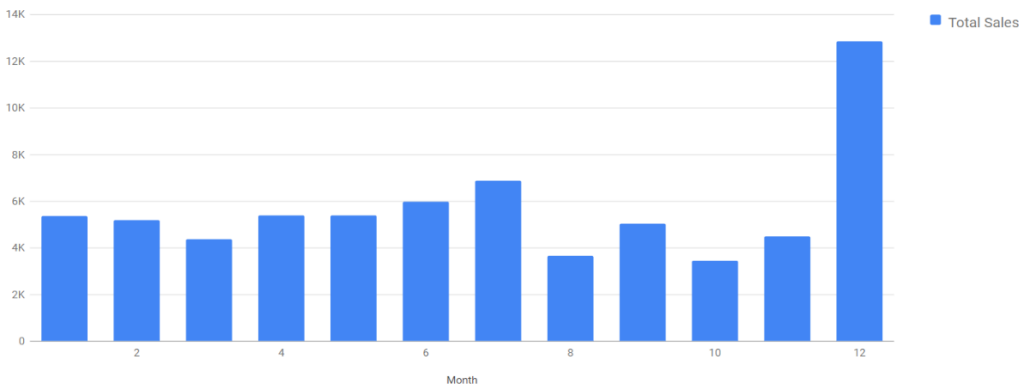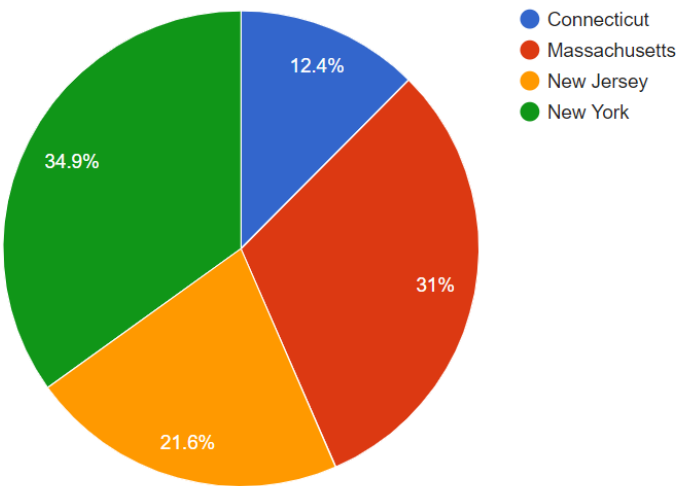
RESULTS

Sales Representative View

Sales representative can only view his sales data.

Total Sales by Month
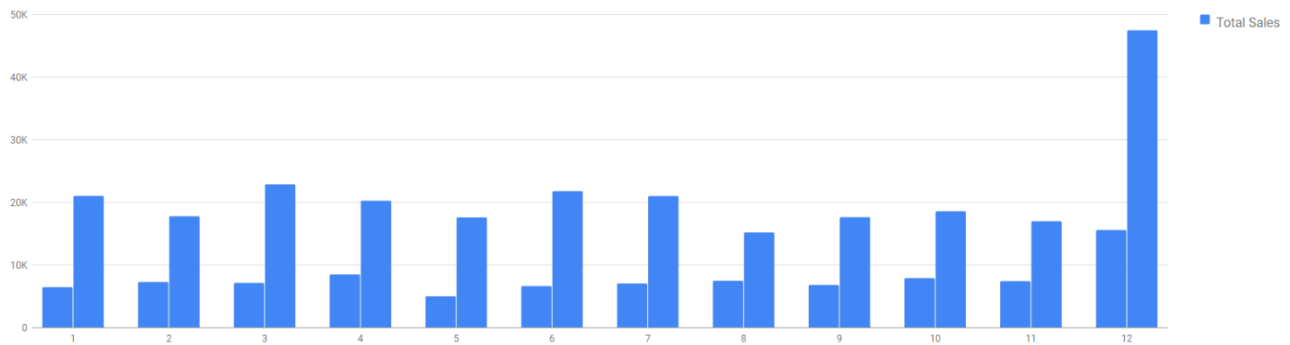

Sales Distribution by Location

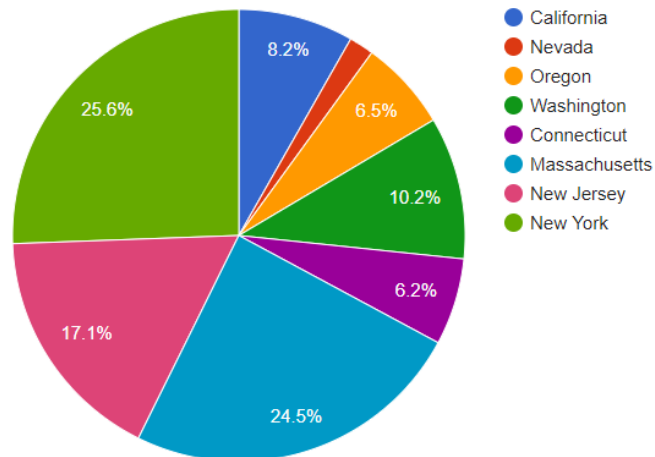|	Sales Representative	Location	Region	Customer	Order Date	Item	Quantity	Price	Total Sale Amount
1	Frances Warren	New York	East	Heather Andrews	2016-01-02	Junk	7	12.42	86.94
2	Frances Warren	Massachusetts	East	Mary Nelson	2016-01-03	Things	8	17.83	142.64
3	Frances Warren	Connecticut	East	Cheryl Henderson	2016-01-04	Junk	7	12.42	86.94
4	Frances Warren	Massachusetts	East	Carl Howard	2016-01-04	Things	9	17.83	160.47
5	Frances Warren	Massachusetts	East	Kevin Torres	2016-01-05	Things	10	17.83	178.3
6	Frances Warren	New Jersey	East	Dorothy Baker	2016-01-05	Stuff	6	16.32	97.92
7	Frances Warren	New York	East	Ralph Gomez	2016-01-05	Widgets	1	53.35	53.35
8	Frances Warren	New York	East	Mark Alexander	2016-01-06	Widgets	6	53.35	320.1
9	Frances Warren	Massachusetts	East	Jerry Butler	2016-01-06	Things	6	17.83	106.98
10	Frances Warren	Massachusetts	East	Joe Russell	2016-01-07	Junk	8	12.42	99.36
11	Frances Warren	Massachusetts	East	Jerry Butler	2016-01-08	Widgets	7	53.35	373.45
12	Frances Warren	Massachusetts	East	Andrew Howard	2016-01-08	Stuff	1	16.32	16.32
13	Frances Warren	New York	East	Joe Ryan	2016-01-08	Stuff	4	16.32	65.28
14	Frances Warren	New York	East	Mark Alexander	2016-01-11	Junk	9	12.42	111.78
15	Frances Warren	Massachusetts	East	Harold Schmidt	2016-01-13	Widgets	2	53.35	106.7
16	Frances Warren	Massachusetts	East	Alice Davis	2016-01-14	Junk	2	12.42	24.84
17	Frances Warren	New York	East	Jessica Lewis	2016-01-15	Things	3	17.83	53.49
18	Frances Warren	Massachusetts	East	Thomas Robinson	2016-01-15	Widgets	10	53.35	533.5
19	Frances Warren	New York	East	Christopher Oliver	2016-01-16	Junk	8	12.42	99.36
20	Frances Warren	New York	East	Joan Harvey	2016-01-17	Junk	7	12.42	86.94
21	Frances Warren	Massachusetts	East	Phillip Young	2016-01-17	Junk	10	12.42	124.2
22	Frances Warren	New Jersey	East	Sean Weaver	2016-01-18	Widgets	9	53.35	480.15
23	Frances Warren	Massachusetts	East	Jerry Palmer	2016-01-18	Things	5	17.83	89.15
24	Frances Warren	Massachusetts	East	Kevin Torres	2016-01-19	Stuff	4	16.32	65.28
25	Frances Warren	New York	East	Joshua Campbell	2016-01-19	Junk	10	12.42	124.2
26	Frances Warren	Massachusetts	East	Linda Morrison	2016-01-20	Junk	4	12.42	49.68
27	Frances Warren	Massachusetts	East	Roger Gomez	2016-01-20	Junk	5	12.42	62.1
28	Frances Warren	Connecticut	East	Alan Dean	2016-01-21	Junk	5	12.42	62.1
29	Frances Warren	Connecticut	East	Cheryl Henderson	2016-01-21	Junk	3	12.42	37.26
30	Frances Warren	New York	East	Janet Freeman	2016-01-22	Widgets	1	53.35	53.35
31	Frances Warren	New Jersey	East	Anthony Ruiz	2016-01-22	Things	7	17.83	124.81
32	Frances Warren	Massachusetts	East	Nancy Meyer	2016-01-23	Widgets	5	53.35	266.75
33	Frances Warren	New York	East	Lori Collins	2016-01-24	Things	6	17.83	106.98
34	Frances Warren	New York	East	Cynthia Ray	2016-01-24	Junk	2	12.42	24.84
35	Frances Warren	New York	East	Judith Woods	2016-01-24	Junk	4	12.42	49.68

Manager View

Manager can only view all of his subordinate's sales data.
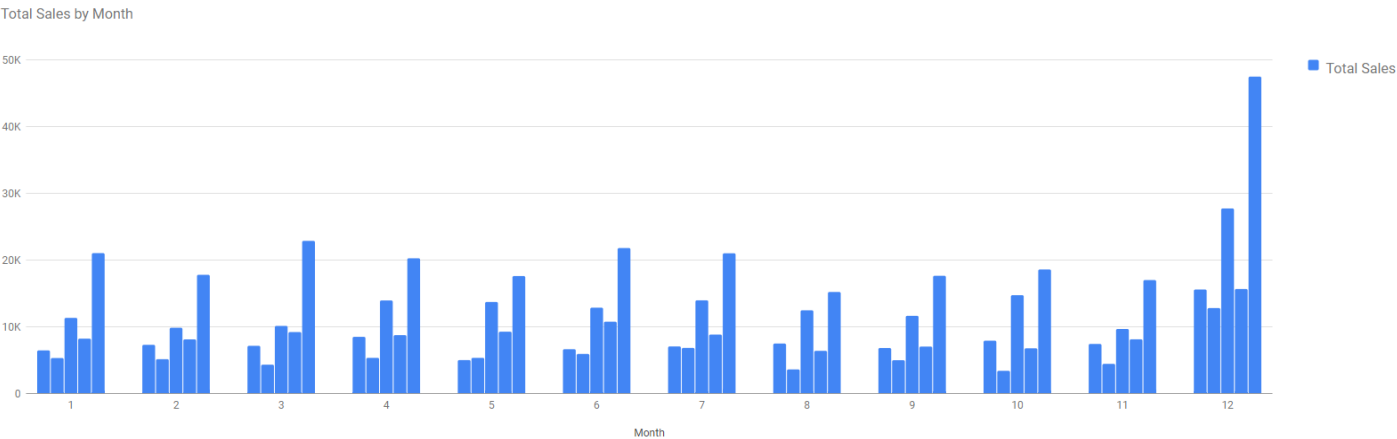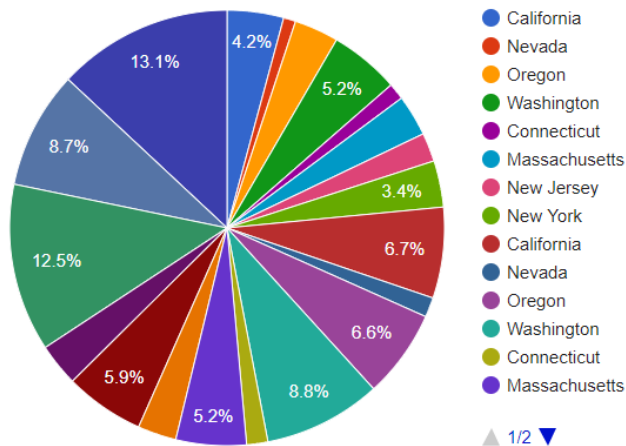
Total Sales by Month

Sales Distribution by Location

	Sales Representative	Location	Region	Customer	Order Date	Item	Quantity	Price	Total Sale Amount
1	Sara Snyder	Massachusetts	East	Raymond Young	2016-01-01	Junk	6	12.42	74.52
2	Sara Snyder	New York	East	Helen Dean	2016-01-01	Junk	7	12.42	86.94
3	Diane Gonzalez	Washington	West	Shirley Chavez	2016-01-01	Stuff	2	16.32	32.64
4	Sara Snyder	New Jersey	East	Brian Ryan	2016-01-01	Junk	1	12.42	12.42
5	Sara Snyder	New Jersey	East	Benjamin Willis	2016-01-01	Things	3	17.83	53.49
6	Sara Snyder	New York	East	Christina Little	2016-01-01	Widgets	6	53.35	320.1
7	Sara Snyder	New York	East	Christopher Oliver	2016-01-02	Junk	8	12.42	99.36
8	Sara Snyder	Massachusetts	East	Walter Kennedy	2016-01-02	Junk	1	12.42	12.42
9	Sara Snyder	New York	East	Gloria Harper	2016-01-02	Stuff	8	16.32	130.56
10	Diane Gonzalez	Washington	West	Christine Wallace	2016-01-02	Junk	4	12.42	49.68
11	Sara Snyder	Massachusetts	East	Lori Shaw	2016-01-02	Stuff	7	16.32	114.24
12	Sara Snyder	New York	East	Sandra Hicks	2016-01-02	Widgets	1	53.35	53.35
13	Sara Snyder	New Jersey	East	Kimberly Coleman	2016-01-02	Things	1	17.83	17.83
14	Sara Snyder	Massachusetts	East	Gary Young	2016-01-03	Things	3	17.83	53.49
15	Sara Snyder	New York	East	Frank Ramos	2016-01-03	Stuff	1	16.32	16.32
16	Diane Gonzalez	Oregon	West	Raymond Matthews	2016-01-03	Junk	1	12.42	12.42
17	Diane Gonzalez	California	West	Mary Rose	2016-01-03	Things	10	17.83	178.3
18	Diane Gonzalez	Washington	West	Denise Henry	2016-01-03	Widgets	9	53.35	480.15
19	Sara Snyder	New York	East	Albert Miller	2016-01-03	Junk	6	12.42	74.52
20	Sara Snyder	New York	East	Anthony Berry	2016-01-03	Stuff	6	16.32	97.92
21	Diane Gonzalez	Washington	West	Joseph Dixon	2016-01-03	Widgets	6	53.35	320.1
22	Sara Snyder	Connecticut	East	Carlos Stephens	2016-01-04	Junk	1	12.42	12.42
23	Diane Gonzalez	Oregon	West	Michael Cruz	2016-01-04	Things	2	17.83	35.66
24	Sara Snyder	New York	East	Anthony Berry	2016-01-04	Stuff	4	16.32	65.28
25	Sara Snyder	New York	East	Betty Stewart	2016-01-04	Junk	10	12.42	124.2
26	Diane Gonzalez	California	West	Jacqueline Little	2016-01-04	Junk	5	12.42	62.1
27	Sara Snyder	Connecticut	East	William Collins	2016-01-04	Widgets	7	53.35	373.45
28	Sara Snyder	Connecticut	East	Jane Watkins	2016-01-05	Stuff	2	16.32	32.64
29	Sara Snyder	Massachusetts	East	Walter Kennedy	2016-01-05	Widgets	8	53.35	426.8
30	Diane Gonzalez	Oregon	West	Phillip Harrison	2016-01-05	Junk	2	12.42	24.84
31	Diane Gonzalez	Oregon	West	Linda Wagner	2016-01-05	Widgets	6	53.35	320.1
32	Sara Snyder	New York	East	Joseph Ryan	2016-01-05	Stuff	6	16.32	97.92
33	Diane Gonzalez	California	West	Diana Hamilton	2016-01-05	Junk	4	12.42	49.68
34	Sara Snyder	New York	East	Billy Reed	2016-01-05	Stuff	5	16.32	81.6
35	Sara Snyder	Massachusetts	East	Brandon King	2016-01-05	Things	5	17.83	89.15

Director View

Director can view all of his subordinate's sales data.

Total Sales by Month

Sales Distribution by Location

	Sales Representative	Location	Region	Customer	Order Date	Item	Quantity	Price	Total Sale Amount
1	Sara Snyder	Massachusetts	East	Raymond Young	2016-01-01	Junk	6	12.42	74.52
2	Sara Snyder	New York	East	Helen Dean	2016-01-01	Junk	7	12.42	86.94
3	Diane Gonzalez	Washington	West	Shirley Chavez	2016-01-01	Stuff	2	16.32	32.64
4	Sara Snyder	New Jersey	East	Brian Ryan	2016-01-01	Junk	1	12.42	12.42
5	Sara Snyder	New Jersey	East	Benjamin Willis	2016-01-01	Things	3	17.83	53.49
6	Patrick Graham	Washington	West	Annie Jenkins	2016-01-01	Widgets	6	53.35	320.1
7	Sara Snyder	New York	East	Christina Little	2016-01-01	Widgets	6	53.35	320.1
8	Patrick Graham	Washington	West	Mary Green	2016-01-01	Stuff	9	16.32	146.88
9	Randy Watson	New York	East	Ruby Matthews	2016-01-02	Things	6	17.83	106.98
10	Sara Snyder	New York	East	Christopher Oliver	2016-01-02	Junk	8	12.42	99.36
11	Randy Watson	Massachusetts	East	Kathryn Fox	2016-01-02	Junk	9	12.42	111.78
12	Patrick Graham	Oregon	West	Carl Lawson	2016-01-02	Junk	4	12.42	49.68
13	Sara Snyder	Massachusetts	East	Walter Kennedy	2016-01-02	Junk	1	12.42	12.42
14	Patrick Graham	Washington	West	Pamela Alexander	2016-01-02	Junk	4	12.42	49.68
15	Sara Snyder	New York	East	Gloria Harper	2016-01-02	Stuff	8	16.32	130.56
16	Randy Watson	New York	East	Harold Hunter	2016-01-02	Widgets	10	53.35	533.5
17	Patrick Graham	Washington	West	Judy Sanchez	2016-01-02	Widgets	7	53.35	373.45
18	Diane Gonzalez	Washington	West	Christine Wallace	2016-01-02	Junk	4	12.42	49.68
19	Sara Snyder	Massachusetts	East	Lori Shaw	2016-01-02	Stuff	7	16.32	114.24
20	Sara Snyder	New York	East	Sandra Hicks	2016-01-02	Widgets	1	53.35	53.35
21	Sara Snyder	Massachusetts	East	Roger Gomez	2016-01-02	Stuff	7	16.32	114.24
22	Sara Snyder	New Jersey	East	Kimberly Coleman	2016-01-02	Things	1	17.83	17.83
23	Frances Warren	New York	East	Heather Andrews	2016-01-02	Junk	7	12.42	86.94
24	Patrick Graham	Oregon	West	Rachel Harris	2016-01-03	Junk	2	12.42	24.84
25	Patrick Graham	Washington	West	Susan Jacobs	2016-01-03	Widgets	9	53.35	480.15
26	Sara Snyder	Massachusetts	East	Gary Young	2016-01-03	Things	3	17.83	53.49
27	Randy Watson	New York	East	Anthony Berry	2016-01-03	Things	9	17.83	160.47
28	Patrick Graham	California	West	Joan Robinson	2016-01-03	Junk	2	12.42	24.84
29	Sara Snyder	New York	East	Frank Ramos	2016-01-03	Stuff	1	16.32	16.32
30	Diane Gonzalez	Oregon	West	Raymond Matthews	2016-01-03	Junk	1	12.42	12.42
31	Patrick Graham	California	West	Mary Rose	2016-01-03	Things	10	17.83	178.3
32	Patrick Graham	Washington	West	Jerry Collins	2016-01-03	Things	9	17.83	160.47
33	Randy Watson	New Jersey	East	Randy Willis	2016-01-03	Things	3	17.83	53.49
34	Diane Gonzalez	Washington	West	Denise Henry	2016-01-03	Widgets	9	53.35	480.15
35	Sara Snyder	New York	East	Albert Miller	2016-01-03	Junk	6	12.42	74.52

Conclusions and Future Scope

In this project we have successfully implemented Role Based Access Control (RBAC). using database approach for analytical dashboard. We considered a sales data for building dashboard and created three hierarchies namely sales representative, manager and director access to the users were given on the role of the user.

We can extend the dashboard functionalities by adding more analytical charts which gives more insights to the user, similar dashboard can be built for various other applications like supply chain, education institutions, cash analytics, administrative organizations and etc.

Reference

1. Sandhu, R., et al.: Role-based Access Control Models. IEEE Computer (1996)
2. M.P. Singh, S. Sural, V. Atluri, J. Vaidya and U. Yakub, "Managing multi-dimensional multi-granular security policies using data warehousing", International Conference on Network and System Security, pp. 221-235, 2015.
3. https://flask.palletsprojects.com/en/1.1.x/ - Flask user guide documentation
4. https://www.postgresql.org/files/documentation/pdf/13/postgresql-13-A4.pdf - PostgreSQL user guide Documentation
5. https://developers-dot-devsite-v2-prod.appspot.com/chart - Google charts tool for interactive charts.