**PROJECT TITLE:**

**PUBLIC TRANSPORTATION ANALYSIS USING IBM COGNUS**

**TEAM MEMBERS:**

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PHASE-I:

1. Project Definition:

Project Definition: The project involves analyzing public transportation data to assess service efficiency, on-time performance, and passenger feedback. The objective is to provide insights that support transportation improvement initiatives and enhance the overall public transportation experience. This project includes defining analysis objectives, collecting transportation data,

designing relevant visualizations in IBM Cognos, and using code for data analysis.

1. Data Collection:

To proceed with the analysis, we need to acquire the necessary public transportation data. The dataset for this project can be accessed through the following link:

https://[www.kaggle.com/datasets/rednivrug/unisys/code](http://www.kaggle.com/datasets/rednivrug/unisys/code)

This dataset encompasses a range of information related to public transportation, including schedules, real-time updates, and passenger feedback. Prior to analysis in IBM Cognos, we will download and perform necessary preprocessing. This may involve tasks such as data cleaning,

transformation, and handling of missing values, format discrepancies, and potential outliers. This ensures that the dataset is primed for meaningful analysis and visualization.

1. Visualization Technique:
2. Chart Selection: Choose suitable chart types (e.g., bar charts, line charts) based on the nature of the data (e.g., time series, categorical) to effectively represent key performance metrics.
3. Comparative Visuals: Create visualizations that facilitate easy comparison between different aspects of public transportation, such as on-time performance across routes or modes

Interactive Filters: Enable users to interactively filter data by relevant factors like date, route, or mode, allowing for customized views of the information.

1. Clear Labels and Legends: Ensure that visualizations include clear labels and legends to provide context and aid interpretation.
2. Dynamic Elements: Leverage IBM Cognos' capabilities to create dynamic visualizations that can adapt to different data sets and user inputs.

This simplified strategy aims to streamline the visualization process while still providing effective insights into public transportation data.

1. Insights Generation:

The primary aim of this public transportation analysis project is to extract valuable insights that can inform decision-making and improve the overall transportation experience. The insights may

encompass:

* Identifying Routes with High or Low Efficiency:
* Determine routes with exceptional or subpar service efficiency metrics to focus on optimization efforts.
* Analyzing Peak Hour Performance:
* Recognize trends in on-time performance during peak travel hours to allocate resources effectively.
* Evaluating Passenger Feedback Trends:
* Understand common feedback themes to address specific concerns and enhance passenger satisfaction.
* Impact of External Factors:
* Investigate how external factors (e.g., weather, holidays) influence transportation efficiency and passenger experience.
* Spotlight on Unusual Patterns:
* Highlight anomalies or irregularities in performance data, which may require special attention.

1. Next Steps:

In the next phase, we'll preprocess the data, ensuring accuracy. We'll then integrate it into IBM Cognos for seamless analysis and visualization. Our focus will be on creating insightful visualizations,

backed by rigorous statistical analysis. Regular collaboration among team members will be pivotal for project success and aligning with defined objectives.

1. Timeline:

A tentative timeline for the project is as follows:

* Data Collection and Preprocessing: 2 weeks
* IBM Cognos Setup and Visualization Design: 3 weeks
* Data Analysis and Insights Generation: 4 weeks
* Documentation and Reporting: 2 weeks
* Review and Finalization: 1 week

**Phase -2**

1. *Data Collection and Integration:*

* Implement an extensive network of IoT sensors and GPS devices on public transportation vehicles and at stations.
* Collect real-time data on vehicle location, passenger counts, traffic conditions, weather, and maintenance status.
* Utilize APIs to integrate data from various sources, including traffic management systems, weather services, and urban development databases.

1. *Data Processing and Analytics:*

* Store data in a secure and scalable cloud infrastructure to facilitate real-time processing and analysis.
* Utilize big data analytics and machine learning algorithms to process and extract insights from the collected data.
* Develop data dashboards for transportation authorities to visualize key performance indicators.

1. *Predictive Modeling:*

* Create predictive models for passenger demand, traffic congestion, and service disruptions.
* Implement machine learning algorithms that continuously update models based on real-time data.
* Utilize predictive modeling to optimize routes, schedules, and vehicle deployment.

1. *Passenger-Centric Solutions:*

* Develop a user-friendly mobile application for passengers.
* Provide real-time information on vehicle locations, estimated arrival times, and service updates.
* Enable mobile ticketing and contactless payment options.

1. *Traffic Management Integration:*

* Collaborate with urban traffic management systems to prioritize public transportation vehicles.
* Implement traffic signal synchronization to minimize delays and congestion.

1. *Sustainability Initiatives:*

* Introduce electric and eco-friendly vehicles into the public transportation fleet.
* Explore renewable energy sources for powering transit systems.
* Monitor and report on the carbon footprint of public transportation.

1. *Accessibility Enhancement:*

* Invest in infrastructure improvements to enhance accessibility for people with disabilities.
* Implement low-floor buses, ramps, and tactile information for the visually impaired.

1. *Public-Private Partnerships:*

* Collaborate with private transportation providers to offer a seamless and integrated multi-modal transportation network.
* Facilitate fare integration and shared data to optimize passenger journeys.

1. *Real-time Feedback and Crowdsourcing:*

* Develop a feedback system within the mobile application for passengers to report issues and provide suggestions.
* Leverage crowdsourced data to identify and address problems in real time.

1. *Open Data and APIs:*

* Make data on public transportation systems available to developers through open APIs.
* Encourage third-party developers to create innovative applications that enhance the passenger experience and contribute to data analysis.

1. *Autonomous Vehicles:*

- Research and implement autonomous vehicles in the public transportation system to improve efficiency and reduce operational costs.

1. *Public Awareness Campaigns:*

- Launch public awareness campaigns to promote the benefits of public transportation, such as reduced congestion and environmental sustainability.

*Funding and Policy Support:*

- Advocate for government funding and supportive policies to implement the IPTOS system and ensure long-term sustainability.

1. *Continuous Improvement:*

- Establish a dedicated team for monitoring system performance, conducting regular assessments, and making necessary adjustments based on data and passenger feedback.

The Integrated Public Transportation Optimization System (IPTOS) aims to revolutionize public transportation by making it more efficient, accessible, and sustainable, resulting in improved urban mobility and reduced environmental impact.

Data Preprocessing :

Data preprocessing in public transportation analysis is a crucial step that involves cleaning, transforming, and organizing raw transportation data to make it suitable for analysis. Public transportation systems generate vast amounts of data from various sources, such as ticketing systems, GPS trackers, sensors, and schedules. Preprocessing this data is necessary to extract meaningful insights, improve data quality, and ensure that it's ready for analytical and modeling tasks. Here are the key aspects of data preprocessing in public transportation analysis:

1. Data Collection:
   * Data collection involves gathering information from various sources, such as fare collection systems, vehicle sensors, passenger counts, and scheduling systems. This raw data can be in different formats and structures.
2. Data Cleaning:
   * Data cleaning is the process of identifying and correcting errors, inconsistencies, and missing values in the dataset. This can include dealing with duplicated records, removing outliers, and addressing data entry errors.
3. Data Integration:
   * Public transportation data often comes from different sources and in various formats. Data integration involves merging, aligning, and transforming data so that it can be analyzed as a cohesive dataset.
4. Data Transformation:
   * Transformation tasks may include converting data into a standardized format, resampling temporal data, and aggregating data to different time intervals (e.g., hourly or daily) to align with analysis requirements.
5. Geospatial Data Processing:
   * Public transportation analysis often involves geospatial data, including GPS coordinates, routes, and geographical boundaries. Preprocessing may involve geocoding, spatial indexing, and the calculation of distances or travel times between locations.

The code used :

#!/usr/bin/env python # coding: utf-8

# In[2]:

#Importing necessary libraries import pandas as pd

import numpy as np

import matplotlib.pyplot as plt import seaborn as sns

# In[3]:

#Loading the dataset data =

pd.read\_csv("C:\\Users\\Maha\\Downloads\\Dataset\\PublicTransportDataset.CS V", low\_memory=False)

# In[4]:

#Displaying the first 20 rows data.head(20)

# In[5]:

# Dropping records which have duplicate values data.drop\_duplicates(inplace=True)

# In[6]:

# Filling missing values with mean data.fillna(data.mean(), inplace=True)

# In[7]:

# Printing the first few rows print(data.head())

# In[8]:

# Generating descriptive statistics of the dataset print(data.describe())

# In[9]:

# Generating concise summary of the dataset

print(data.info()) # In[11]:

# Shape of the dataset print(data.shape)

# In[12]:

# Displaying first few rows after preprocessing data.head()

In [2]:

*#Importing necessary libraries* import pandas as pd

import numpy as np

import matplotlib.pyplot as plt import seaborn as sns

In [3]:

*#Loading the dataset*

data = pd.read\_csv("C: Users AbiramiSV Downloads Dataset PublicT

In [4]:

*#Displaying the first 20 rows* data.head(20)

**3** 23633 100 12266 Zone A Arndale

00:00:00

2013-06-30

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Out[4]: |  | | | | |
|  |  | **TripID** | **RouteID** | **StopID** | **StopName WeekBeginning NumberOfBoardings** |
|  | **0** | 23631 | 100 | 14156 | 181 Cross Rd 2013-06-30 1  00:00:00 |
|  | **1** | 23631 | 100 | 14144 | 177 Cross Rd 2013-06-30 1  00:00:00 |
|  | **2** | 23632 | 100 | 14132 | 175 Cross Rd 2013-06-30 1 |

00:00:00 2

|  |  |  |  |
| --- | --- | --- | --- |
|  | | | Interchange |
| **4** 23633 | 100 | 14147 | 178 Cross Rd |
| **5** 23634 | 100 | 13907 | 9A Marion Rd |
| **6** 23634 | 100 | 14132 | 175 Cross Rd |
| **7** 23634 | 100 | 13335 | 9A Holbrooks Rd |
| **8** 23634 | 100 | 13875 | 9 Marion Rd |
| **9** 23634 | 100 | 13045 | 206 Holbrooks Rd |
| **10** 23635 | 100 | 13335 | 9A Holbrooks Rd |
| **11** 23635 | 100 | 13383 | 8A Marion Rd |
| **12** 23635 | 100 | 13586 | 8D Marion Rd |
| **13** 23635 | 100 | 12726 | 23 Findon Rd |
| **14** 23635 | 100 | 13813 | 8K Marion Rd |
| **15** 23635 | 100 | 14062 | 20 Cross Rd |
| **16** 23636 | 100 | 12780 | 22A Crittenden Rd |
| **17** 23636 | 100 | 13383 | 8A Marion Rd |
| **18** 23636 | 100 | 14154 | 180 Cross Rd |
| **19** 23636 | 100 | 13524 | 8C Marion Rd |

2013-06-30

00:00:00 1

2013-06-30

00:00:00 1

2013-06-30

00:00:00 1

2013-06-30

00:00:00 1

2013-06-30

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2013-06-30

00:00:00 1

2013-06-30

00:00:00 2

2013-06-30

00:00:00 3

In [5]:

*# Dropping records which have duplicate values* data.drop\_duplicates(inplace=True)

In [6]:

*# Filling missing values with mean* data.fillna(data.mean(), inplace=True)

In [7]:

*# Printing the first few rows* print(data.head())

TripID RouteID StopID StopName WeekBeg inning \

0 23631 100 14156 181 Cross Rd 2013-06-30 0

0:00:00

1 23631 100 14144 177 Cross Rd 2013-06-30 0

0:00:00

2 23632 100 14132 175 Cross Rd 2013-06-30 0

0:00:00

3 23633 100 12266 Zone A Arndale Interchange 2013-06-30 0

0:00:00

4 23633 100 14147 178 Cross Rd 2013-06-30 0

0:00:00

NumberOfBoardings 0 1

1 1

2 1

3 2

4 1

In [8]:

*# Generating descriptive statistics of the dataset* print(data.describe())

|  |  |  |  |
| --- | --- | --- | --- |
|  | TripID | StopID | NumberOfBoardings |
| count | 1.085723e+07 | 1.085723e+07 | 1.085723e+07 |
| mean | 2.952100e+04 | 1.366132e+04 | 4.743737e+00 |
| std | 1.960938e+04 | 1.971760e+03 | 9.382286e+00 |
| min | 7.900000e+01 | 1.000100e+04 | 1.000000e+00 |
| 25% | 1.191700e+04 | 1.231100e+04 | 1.000000e+00 |
| 50% | 2.747900e+04 | 1.334600e+04 | 2.000000e+00 |
| 75% | 4.885800e+04 | 1.491600e+04 | 4.000000e+00 |
| max | 6.553500e+04 | 1.871500e+04 | 9.770000e+02 |

In [9]:

*# Generating concise summary of the dataset* print(data.info())

<class 'pandas.core.frame.DataFrame'> Int64Index: 10857234 entries, 0 to 10857233 Data columns (total 6 columns):

# Column Dtype

1. TripID int64
2. RouteID object
3. StopID int64
4. StopName object
5. WeekBeginning object
6. NumberOfBoardings int64 dtypes: int64(3), object(3) memory usage: 579.8+ MB

None

In [11]:

*# S ape of the dataset* print(data.shape)

(10857234, 6)

In [12]:

*# Displaying first few rows after preprocessing* data.head()

**3** 23633 100 12266 Zone A Arndale

Interchange

00:00:00

2013-06-30

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Out[12]: |  | | | | |
|  |  | **TripID** | **RouteID** | **StopID** | **StopName WeekBeginning NumberOfBoardings** |
|  | **0** | 23631 | 100 | 14156 | 181 Cross Rd 2013-06-30 1  00:00:00 |
|  | **1** | 23631 | 100 | 14144 | 177 Cross Rd 2013-06-30 1  00:00:00 |
|  | **2** | 23632 | 100 | 14132 | 175 Cross Rd 2013-06-30 1 |

00:00:00 2

**4** 23633 100 14147 178 Cross Rd 2013-06-30 1

00:00:00

In [ ]:

**External Features**

Some Important external data fields calculation

* + - **IsHoliday** Number of public holidays within that week
    - **DistanceFromCentre** Distance measure from the city centre

For Calculating Distance between centre with other bus stops by using Longitude and Latitude we have used the Haversine formula

from math import sin, cos, sqrt, atan2, radiansdef calc\_dist(lat1,lon1):

*## approximate radius of earth in km*

R = 6373.0

dlon = radians(138.604801) - radians(lon1)

dlat = radians(-34.921247) - radians(lat1)

In [8]:

a = sin(dlat / 2)\*\*2 + cos(radians(lat1)) \* cos(radians(-34.921247)) \* sin(dl on / 2)\*\*2

c = 2 \* atan2(sqrt(a), sqrt(1 - a))

return R \* c

In [9]:

out\_geo['dist\_from\_centre'] = out\_geo[['latitude','longitude']].apply(lambda x:

calc\_dist(\*x), axis=1)

In [10]:

*##Fill the missing values with mode*out\_geo['type'].fillna('street\_address',inpl ace=True)out\_geo['type'] = out\_geo['type'].apply(lambda x: str(x).split(',')[-1])

In [11]:

out\_geo['type'].unique()

array(['street\_address', 'transit\_station', 'premise', 'political', 'school', 'route', 'intersection', 'point\_of\_interest',

Out[11]:

'subpremise', 'real\_estate\_agency', 'university', 'travel\_agency', 'restaurant', 'supermarket', 'store', 'post\_office'], dtype=object)

Adding the details regarding the Public holidays from June 2013 to June 2014

In [12]:

*'''Holidays--2013-09-01,Father's Day2013-10-07,Labour day2013-12-25,Chr istmas day2013-12-26,Proclamation Day2014-01-01,New Year2014-01-27,A ustralia Day2014-03-10,March Public Holiday2014-04-18,Good Friday2014*

*-04-19,Easter Saturday2014-04-21,Easter Monday2014-04-25,Anzac Day201 4-06-09,Queen's Birthday'''*

Out[12]:

"Holidays--\n2013-09-01,Father's Day\n2013-10-07,Labour day\n2013-12-25, Christmas day\n2013-12-26,Proclamation Day\n2014-01-01,New Year\n2014- 01-27,Australia Day\n2014-03-10,March Public Holiday\n2014-04-18,Good Fr iday\n2014-04-19,Easter Saturday\n2014-04-21,Easter Monday\n2014-04-25,A nzac Day\n2014-06-09,Queen's Birthday"

In [13]:

def holiday\_label (row):

if row == datetime.date(2013, 9, 1) :

return '1'

if row == datetime.date(2013, 10, 6) :

return '1'

if row == datetime.date(2013, 12, 22) :

return '2'

if row == datetime.date(2013, 12, 29):

return '1'

if row == datetime.date(2014, 1, 26):

return '1'

if row == datetime.date(2014, 3, 9):

return '1'

if row == datetime.date(2014, 4, 13) :

return '2'

if row == datetime.date(2014, 4, 20):

return '2'

if row == datetime.date(2014, 6, 8):

return '1'

return '0'

In [14]:

data['WeekBeginning'] = pd.to\_datetime(data['WeekBeginning']).dt.date

In [15]:

data['holiday\_label'] = data['WeekBeginning'].apply (lambda row: holiday\_la bel(row))

# Data Aggregation

Combine the Geolocation,Routes and main input file to get final Output File.

In [16]:

data= pd.merge(data,out\_geo,how='left',left\_on = 'StopName',right\_on = 'inp ut\_string')

In [17]:

data = pd.merge(data, route, how='left', left\_on = 'RouteID', right\_on = 'route

\_id')

Columns to keep for further analysis

In [18]:

col = ['TripID', 'RouteID', 'StopID', 'StopName', 'WeekBeginning','NumberOf Boardings','formatted\_address',

'latitude', 'longitude','postcode','type','route\_desc','dist\_from\_centre','holid ay\_label']

data = data[col]

In [19]:

In [20]:

*##saving the final dataset*data.to\_csv('Weekly\_Boarding.csv',index=False)

In [21]:

*## getting the addresses for geolocation api.# Address data['StopName'].uniq ue()# sub = pd.DataFrame({'Address': Address})# sub=sub.reindex(columns*

*=["Address"])# sub.to\_csv('addr.csv')*

Aggregate the Data According to Weeks and Stop names

* + - **NumberOfBoardings\_sum** Number of Boardings within particular week for each Bus stop
    - **NumberOfBoardings\_count** Number of times data is recorded within week
    - **NumberOfBoardings\_max** Maximum number of boarding done at single time within week

In [22]:

*# st\_week\_grp1 = pd.DataFrame(data.groupby(['StopName','WeekBeginning ','type']).agg({'NumberOfBoardings': ['sum', 'count']})).reset\_index()*grouped

= data.groupby(['StopName','WeekBeginning','type']).agg({'NumberOfBoardi ngs': ['sum', 'count','max']})grouped.columns = ["\_".join(x) for x **in** grouped.c olumns.ravel()]

In [23]:

st\_week\_grp = pd.DataFrame(grouped).reset\_index()st\_week\_grp.shapest\_w eek\_grp.head()

(207864, 6)

Out[23]:

Out[23]:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Stop Name | WeekBe ginning | type | NumberOfBoa rdings\_sum | NumberOfBoar dings\_count | NumberOfBoa rdings\_max |
| 0 | 1  Anza c Hwy | 2013-06-  30 | street\_a ddress | 1003 | 378 | 51 |
| 1 | 1  Anza c Hwy | 2013-07-  07 | street\_a ddress | 783 | 360 | 28 |
| 2 | 1  Anza c Hwy | 2013-07-  14 | street\_a ddress | 843 | 343 | 45 |
| 3 | 1  Anza c | 2013-07-  21 | street\_a ddress | 710 | 356 | 28 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Stop Name | WeekBe ginning | type | NumberOfBoa rdings\_sum | NumberOfBoar dings\_count | NumberOfBoa rdings\_max |
|  | Hwy |  |  |  |  |  |
| 4 | 1  Anza c Hwy | 2013-07-  28 | street\_a ddress | 898 | 379 | 41 |

Gathering only the Stop Name which having all 54 weeks of Data

In [24]:

st\_week\_grp1 = pd.DataFrame(st\_week\_grp.groupby('StopName')['WeekBeg inning'].count()).reset\_index()

In [25]:

aa=list(st\_week\_grp1[st\_week\_grp1['WeekBeginning'] == 54]['StopName'])

In [26]:

bb = st\_week\_grp[st\_week\_grp['StopName'].isin(aa)]

*## save the aggregate data*bb.to\_csv('st\_week\_grp.csv', index=False)

In [27]:

# Data Exploration

Total Having 1 Year of Data from date 2013-06-30 till 2014-07-06 in a Weekly interval based.

Having Total of 4165 Stops in South Australian Metropolitan Area.

data.nunique() TripID 39282

RouteID 619

StopID 7397

StopName 4165

WeekBeginning 54

NumberOfBoardings 400

formatted\_address 3242

|  |  |
| --- | --- |
| latitude | 3029 |
| longitude | 3008 |
| postcode | 207 |
| type | 16 |
| route\_desc | 440 |

dist\_from\_centre 3033

holiday\_label 3

dtype: int64 data.shapedata.columnsdata.head(3) (10857234, 14)

Index(['TripID', 'RouteID', 'StopID', 'StopName', 'WeekBeginning',

'NumberOfBoardings', 'formatted\_address', 'latitude', 'longitude',

In [28]:

Out[28]:

In [29]:

Out[29]:

Out[29]:

'postcode', 'type', 'route\_desc', 'dist\_from\_centre', 'holiday\_label'],

dtype='object')

Out[29]:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | T  ri pI D | R  ou teI D | St o pI D | Sto pN am e | Wee kBeg innin g | Numb erOfB oardin gs | forma tted\_ addre ss | lati tud e | lon gitu de | po stc od e | type | rou te\_ des c | dist\_ from  \_cent re | holi day  \_lab el |
| 0 | 2  3  6  3  1 | 10  0 | 1  4  1  5  6 | 18  1  Cr oss Rd | 2013  -06-  30 | 1 | 181  Cross Rd, West bourn e Park SA 5041,  Austr alia | -  34.  96  66  56 | 138  .59  214  8 | 50  41 | stre et\_a ddre ss | via W  oo dvi lle Ro ad, Ho lbr oo ks Ro ad, Ma rio n Ro a... | 5.18  0961 | 0 |
| 1 | 2  3  6  3  1 | 10  0 | 1  4  1  4  4 | 17  7  Cr oss Rd | 2013  -06-  30 | 1 | 177  Cross Rd, West bourn e Park SA 5041,  Austr alia | -  34.  96  66  07 | 138  .59  230  1 | 50  41 | stre et\_a ddre ss | via W  oo dvi lle Ro ad, Ho lbr oo ks Ro ad, Ma rio n Ro a... | 5.17  2525 | 0 |
| 2 | 2 | 10 | 1 | 17 | 2013 | 1 | 175 | - | 138 | 50 | stre | via | 5.18 | 0 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | T  ri pI D | R  ou teI D | St o pI D | Sto pN am e | Wee kBeg innin g | Numb erOfB oardin gs | forma tted\_ addre ss | lati tud e | lon gitu de | po stc od e | type | rou te\_ des c | dist\_ from  \_cent re | holi day  \_lab el |
|  | 3  6  3  2 | 0 | 4  1  3  2 | 5  Cr oss Rd | -06-  30 |  | Cross Rd, West bourn e Park SA 5041,  Austr alia | 34.  96  67  58 | .59  271  5 | 41 | et\_a ddre ss | W  oo dvi lle Ro ad, Ho lbr oo ks Ro ad, Ma rio n Ro a... | 0709 |  |

data.isnull().sum() TripID 0

RouteID 0

StopID 0

StopName 0

WeekBeginning 0

NumberOfBoardings 0

formatted\_address 3506

latitude 0

longitude 0

postcode 425081

type 0

route\_desc 2106618

In [30]:

Out[30]:

dist\_from\_centre 0

holiday\_label 0

dtype: int64

How Many different type of Unique Data in the dataset

data['WeekBeginning'].unique() array([datetime.date(2013, 6, 30), datetime.date(2013, 7, 7),

datetime.date(2013, 7, 14), datetime.date(2013, 7, 21),

datetime.date(2013, 7, 28), datetime.date(2013, 8, 4),

datetime.date(2013, 8, 11), datetime.date(2013, 8, 18),

datetime.date(2013, 8, 25), datetime.date(2013, 9, 1),

datetime.date(2013, 9, 8), datetime.date(2013, 9, 15),

datetime.date(2013, 9, 22), datetime.date(2013, 9, 29),

datetime.date(2013, 10, 6), datetime.date(2013, 10, 13),

datetime.date(2013, 10, 20), datetime.date(2013, 10, 27),

datetime.date(2013, 11, 3), datetime.date(2013, 11, 10),

datetime.date(2013, 11, 17), datetime.date(2013, 11, 24),

datetime.date(2013, 12, 1), datetime.date(2013, 12, 8),

datetime.date(2013, 12, 15), datetime.date(2013, 12, 22),

datetime.date(2013, 12, 29), datetime.date(2014, 1, 5),

datetime.date(2014, 1, 12), datetime.date(2014, 1, 19),

datetime.date(2014, 1, 26), datetime.date(2014, 2, 2),

datetime.date(2014, 2, 9), datetime.date(2014, 2, 16),

datetime.date(2014, 2, 23), datetime.date(2014, 3, 2),

datetime.date(2014, 3, 9), datetime.date(2014, 3, 16),

datetime.date(2014, 3, 23), datetime.date(2014, 3, 30),

datetime.date(2014, 4, 6), datetime.date(2014, 4, 13),

In [31]:

Out[31]:

datetime.date(2014, 4, 20), datetime.date(2014, 4, 27),

datetime.date(2014, 5, 4), datetime.date(2014, 5, 11),

datetime.date(2014, 5, 18), datetime.date(2014, 5, 25),

datetime.date(2014, 6, 1), datetime.date(2014, 6, 8),

datetime.date(2014, 6, 15), datetime.date(2014, 6, 22),

datetime.date(2014, 6, 29), datetime.date(2014, 7, 6)], dtype=object)

# Data Visualization

In [32]:

*##can assign the each chart to one axes at a time*fig,axrr=plt.subplots(3,2,figs ize=(18,18))

data['NumberOfBoardings'].value\_counts().sort\_index().head(20).plot.bar(ax

=axrr[0][0])data['WeekBeginning'].value\_counts().plot.area(ax=axrr[0][1])dat a['RouteID'].value\_counts().head(20).plot.bar(ax=axrr[1][0])data['RouteID'].v alue\_counts().tail(20).plot.bar(ax=axrr[1][1])data['type'].value\_counts().head (5).plot.bar(ax=axrr[2][0])data['type'].value\_counts().tail(10).plot.bar(ax=axrr [2][1])

<matplotlib.axes.\_subplots.AxesSubplot at 0x7f1726f9e860>

<matplotlib.axes.\_subplots.AxesSubplot at 0x7f1615adbb38>

<matplotlib.axes.\_subplots.AxesSubplot at 0x7f1645050f28>

<matplotlib.axes.\_subplots.AxesSubplot at 0x7f171ef36588>

<matplotlib.axes.\_subplots.AxesSubplot at 0x7f171ef5dc50>

<matplotlib.axes.\_subplots.AxesSubplot at 0x7f171ef0d2e8>

Out[32]:

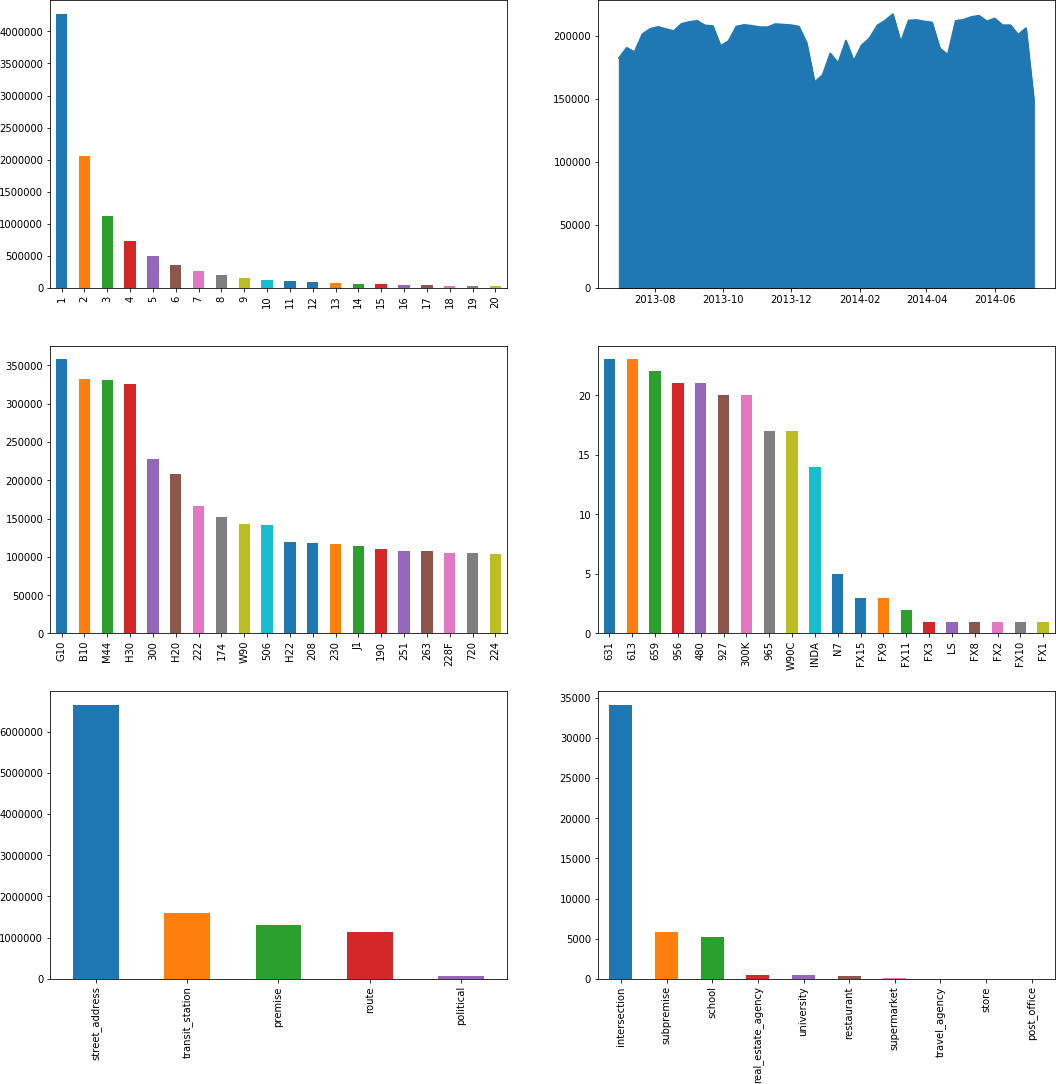
Out[32]:

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Out[32]:



# Inferences:

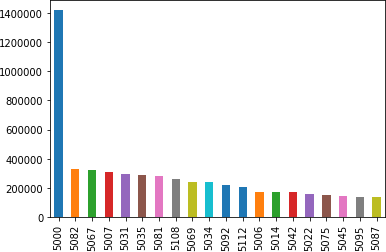
* + - More than 40 lakhs times only single person board from the bus stop.
    - There are average of 1.8 lakhs people travel every week by bus in adelaide metropolitan area.
    - G10,B10,M44,H30 are the most busiest routes in the city while FX8,FX3,FX10,FX1,FX2 are the least.
    - Most of the Bus stops are Street\_Address Type while there are very few which are store or post office.

data['postcode'].value\_counts().head(20).plot.bar()

In [33]:

Out[33]:

<matplotlib.axes.\_subplots.AxesSubplot at 0x7f171b4c0c50>



In [34]:

*# data['dist\_from\_centre'].nunique()*bb\_grp = data.groupby(['dist\_from\_centr e']).agg({'NumberOfBoardings': ['sum']}).reset\_index()bb\_grp.columns = bb\_ grp.columns.get\_level\_values(0)bb\_grp.head()bb\_grp.columns

Out[34]:

|  |  |  |
| --- | --- | --- |
|  | dist\_from\_centre | NumberOfBoardings |
| 0 | 0.000018 | 1892443 |
| 1 | 0.131368 | 167535 |
| 2 | 0.309089 | 356518 |
| 3 | 0.314937 | 1484824 |
| 4 | 0.326005 | 120061 |

Index(['dist\_from\_centre', 'NumberOfBoardings'], dtype='object') trace0 = go.Scatter(

x = bb\_grp['dist\_from\_centre'],

Out[34]:

In [35]:

y = bb\_grp['NumberOfBoardings'],mode = 'lines+markers',name = 'X2 Kin g William St')

data1 = [trace0]layout = dict(title = 'Distance Vs Number of boarding',

xaxis = dict(title = 'Distance from centre'),

yaxis = dict(title = 'Number of Boardings'))fig = dict(data=data1, lay out=layout)iplot(fig)

05k10k15k00.5M1M1.5M2MExport to plot.ly »Distance Vs Number of boardingDistance from centreNumber of Boardings

# Inferences:

* + - As we move away from centre the number of Boarding decreases
    - There are cluster of bus stops near to the main Adelaide city as oppose to outside.so that's why most of boardings are near to center

# Using Bokeh

Plot the Bus stop on the Google Map using the latitude and longitude of the bus stop address

In [36]:

lat = out\_geo['latitude'].tolist()long = out\_geo['longitude'].tolist()nam = out\_g eo['input\_string'].tolist()

In [37]:

map\_options = GMapOptions(lat=-34.96, lng=138.592, map\_type="roadmap ", zoom=9)key = open('../input/geolockey/api\_key.txt').read()p = gmap(key, map\_options, title="Adelaide South Australia")source = ColumnDataSource (data=dict(lat=lat,lon=long,nam=nam))

p.circle(x="lon", y="lat", size=5, fill\_color="blue", fill\_alpha=0.8, source=so urce)TOOLTIPS = [("Place", "@nam")]p.add\_tools( HoverTool(tooltips=TO OLTIPS))output\_notebook()show(p)

Out[37]:

# Inferences:

* + It has Geospatial coverage Area from Lat: 34.3862 to -35.3655 and Lon: 138.4126 to 139.1089. Which is Total 152 KM long Area from Daniel Road to Mosquito Creek Road on one side and Total 162 KM Stretch from Truro to Myponga Beach on the other side.
  + There are cluster of bus stops near to the main Adelaide city as oppose to outside.

source\_6 = bb[bb['StopName'] == '57A Hancock Rd'].reset\_index(drop = Tru e)source\_7 = bb[bb['StopName'] == '37 Muriel Dr'].reset\_index(drop = True) source\_8 = bb[bb['StopName'] == '18B Springbank Rd'].reset\_index(drop = T rue)source\_9 = bb[bb['StopName'] == '27E Sir Ross Smith Av'].reset\_index(d

rop = True)source\_10 = bb[bb['StopName'] == '46A Baldock Rd'].reset\_index (drop = True)

In [42]:

trace0 = go.Scatter(

x = source\_6['WeekBeginning'],

y = source\_6['NumberOfBoardings\_sum'],mode = 'lines+markers',name = ' 57A Hancock Rd')trace1 = go.Scatter(

x = source\_7['WeekBeginning'],

y = source\_7['NumberOfBoardings\_sum'],mode = 'lines+markers',name = ' 37 Muriel Dr')trace2 = go.Scatter(

x = source\_8['WeekBeginning'],

y = source\_8['NumberOfBoardings\_sum'],mode = 'lines+markers',name = ' 18B Springbank Rd')trace3 = go.Scatter(

x = source\_9['WeekBeginning'],

y = source\_9['NumberOfBoardings\_sum'],mode = 'lines+markers',name = ' 27E Sir Ross Smith Av')trace4 = go.Scatter(

x = source\_10['WeekBeginning'],

y = source\_10['NumberOfBoardings\_sum'],mode = 'lines+markers',name =

'46A Baldock Rd')

data = [trace0,trace1,trace2,trace3,trace4]layout = dict(title = 'Weekly Boardi ng Total',

xaxis = dict(title = 'Week Number'),

yaxis = dict(title = 'Number of Boardings'),

shapes = [{*# Holidays Record: 2013-09-01*'type': 'line','x0': '2013-09- 01','y0': 0,'x1': '2013-09-02','y1': 80,'line': {

'color': 'rgb(55, 128, 191)','width': 1,'dash': 'dashdot'},},

{*# 2013-10-07*'type': 'line','x0': '2013-10-07','y0': 0,'x1': '2013-10-07','

y1': 80,'line': {

'color': 'rgb(55, 128, 191)','width': 1,'dash': 'dashdot'},},

y1': 80,'line': {

{*# 2013-12-25*'type': 'line','x0': '2013-12-25','y0': 0,'x1': '2013-12-26','

'color': 'rgb(55, 128, 191)','width': 3,'dash': 'dashdot'},},

y1': 80,'line': {

{*# 2014-01-27*'type': 'line','x0': '2014-01-27','y0': 0,'x1': '2014-01-28','

'color': 'rgb(55, 128, 191)','width': 1,'dash': 'dashdot'},},

y1': 80,'line': {

{*# 2014-03-10*'type': 'line','x0': '2014-03-10','y0': 0,'x1': '2014-03-11','

'color': 'rgb(55, 128, 191)','width': 1,'dash': 'dashdot'},},

y1': 80,'line': {

{*# 2014-04-18*'type': 'line','x0': '2014-04-18','y0': 0,'x1': '2014-04-19','

'color': 'rgb(55, 128, 191)','width': 3,'dash': 'dashdot'},},

y1': 80,'line': {

{*# 2014-06-09*'type': 'line','x0': '2014-06-09','y0': 0,'x1': '2014-06-10','

'color': 'rgb(55, 128, 191)','width': 1,'dash': 'dashdot'},},])fig = dict(data= data, layout=layout)iplot(fig)

Jul 2013Sep 2013Nov 2013Jan 2014Mar 2014May 2014Jul 2014020406080100120Export to plot.ly »57A Hancock Rd37 Muriel Dr18B Springbank Rd27E Sir Ross Smith Av46A Baldock RdWeekly Boarding TotalWeek NumberNumber of Boardings

# Inferences:

* + Same decreasing affect of Holidays on number of people travelling through bus can be seen in other city bus stops also.
  + The width of vertical blue line shows the number of holidays come within that week period.
  + Two thickest blue lines shows Christmas and New year period while other one was easter & Good friday period.on both the occassion number of public holidays within week period was 3.