Strategy Support System for Maharashtra Police

Project 3
Interaction Design
Varun Mevada
15 633 0007

Guide: Prof. Venkatesh R.

IDC School of Design
IIT Bombay

Approval Sheet

The Interaction Design Project III entitled **"Strategy Support System for Maharashtra Police"** by Varun Mevada, Roll Number 156330007 is approved, in partial fulfillment of the Master in Design Degree in Interaction Design at IDC School of Design, Indian Institute of Technology Bombay.

Guide:

Internal:

External:

Chairpersron:

Declaration

I declare that this written document represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources.

I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea / data / fact / source in my submission.

I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Varun Mevada
156330007
IDC School of Design,
Indian Institure of Technology Bombay
2017

Acknowledgement

I would like to thank my **guide Prof. Venkatesh Rajamanickam** for his support, time and guidance through the duration of this project. I am grateful to **Prof. Girish Dalvi, Prof. Ravi Poovaiah, Prof. Jayesh Pillai**, **Prof. Anirudha Joshi** and **Prof. Pramod Khambate** at IDC for their valuable feedback and suggestions.

A sincere gratitude to the Maharashtra Police Department **A.D.G.P. Dr. Pradnya Saravade** for giving us the opportunity to work on the project. I would also like to thank **Mr. Ajay Mahindrikar (Technical Head)** for providing the necessary information from time to time.

I immensely appreciate **Mr. Girish Mehta** for coding the prototype.

All participants who became a part of the project of user testing and interviews. I would also like to extend my gratitude towards **my parents**, the pillar of my strength.

I would also like to thank my **batchmates** for their constant support and motivation.

Abstract

Crime rates have been (increasing) at an alarming rate. The Maharashtra Police department is trying in every possible manner to increase the detection rate in order to (stop) these crimes. But it becomes very difficult to have a bird's eye view on the state's crime rates with the traditional methods. Gathering information from every source possible is time consuming.

Using data visualizations for these datasets provide a quick and accurate overview of the ground realities for the higher officials. This helps them to focus on the pain points (quickly) and take necessary actions. Currently the tool is catering to the crime tracking variable only. The administrative additions would come at a later stage which would have (Motorcade) utilization and expenses, Hospitalization, Expenditure review, etc. also included. The project focuses on creating more intuitive system for better and quick insights of the data sets, explorations of different visualization methods and to test the outcome in terms of time spent by the Police officers.

Contents

1. Introduction

In today's digital age, data is considered to be prime information. Huge data sets can provide immeasurable valuable insights in terms of visualizing trends.

In a populous country like India crime has been one of the major matters of concern. The traditional methods to collect and store data prove to be time consuming in today's age and amount of information. Various mediums and methods of storing and retrieving data can save the day for the governing bodies.

There are huge benefits of data visualization technology to the police force as well as the community. These visualizations helps them see trends over the years in no time and they can see the bigger picture. Without the ability to visualize the bigger picture, critical information can be missed out which can lead to incorrect or no action at all. This helps them to prepare for any suspicious activity or crime. Strategic reports, tactical and visual analytics can be swiftly created and can be viewed across multiple platforms.

When a single channel of information is layered across other layers such as traffic, geospatial and weather it can lead to deeper insights and co-relations between events.

Unlike terrorist attacks crimes which take place on a daily basis, these crime data visualizations help the police in setting up patrol parties *(Zhang, et al. 2015).*

1.1. Objective

The aim of the project is to provide the police department a tool, which will help them to see the bigger picture at a glance and strategize against a growing trend or fore coming alerts. The project explores different visualization techniques and choose from them the best suited for the purpose. Intuitive methods to work through the geospatial and bar and trend chart data sets.

2. Secondary Research

There have been many case studies for crime data visualizations. Many of them are open data sets and easily accessible by the public. The purpose of this project is for a specific target audience, higher police officials of the Maharashtra police department. The data in for now stands confidential and a certain part of it may be opened to the public at a later stage. These data sets than can prove vital enough for public to take decisions such as buying a property in a certain vicinity.

2.1. Crime and Criminal Tracking Network & Systems (CCTNS)

It aims to create an integrated system for better governance and a nationwide networking infrastructure for investigating crime and detection of criminals. Crime and Criminal Tracking Network & Systems (CCTNS) is a plan scheme conceived in the light of experience of a non-plan scheme namely - Common Integrated Police Application (CIPA). CCTNS is a Mission Mode Project under the National e-Governance Plan of Govt of India. *[National Crime Records Bureau n.d.]*

Objectives of 'CCTNS'

- Make the Police functioning citizen friendly and more transparent by automating the functioning of Police Stations.
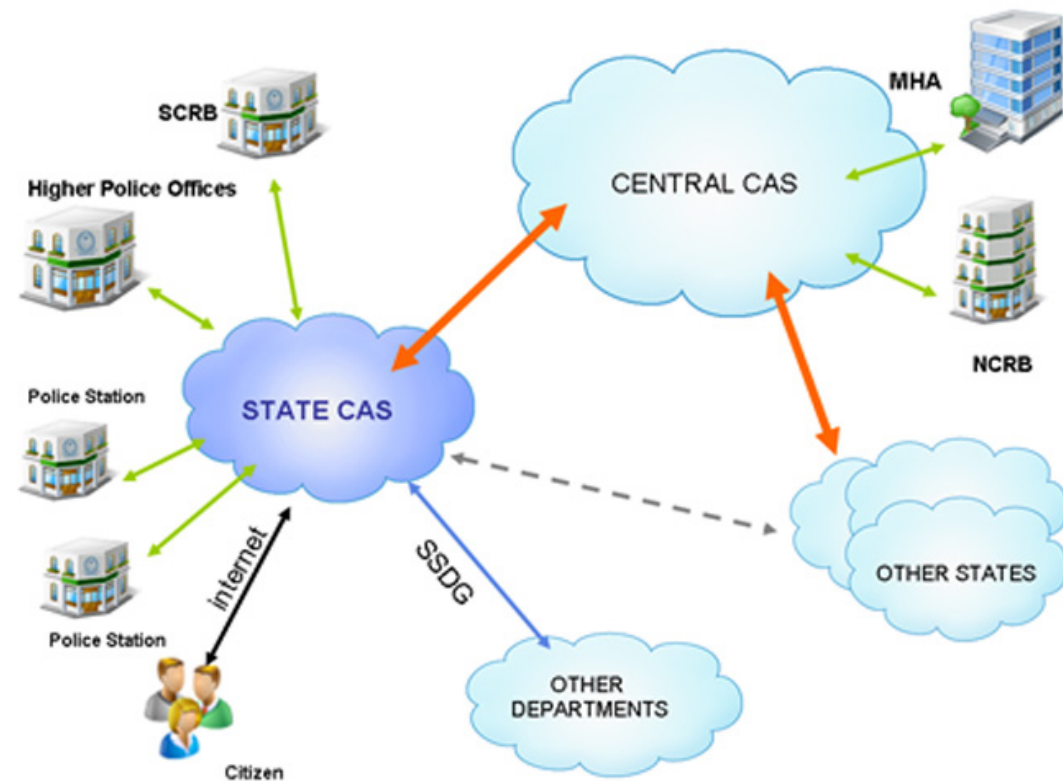- Improve delivery of citizen-centric services through effective

Fig. 1   System Architecture for C.C.T.N.S (Image source: http://ncrb.gov.in)

usage of ICT.
- Provide the Investigating Officers of the Civil Police with tools, technology and information to facilitate investigation of crime and detection of criminals.
- Improve Police functioning in various other areas such as Law and Order, Traffic Management etc.
- Facilitate Interaction and sharing of Information among Police

Stations, Districts, State/UT headquarters and other Police Agencies.

- Assist senior Police Officers in better management of Police Force
- Keep track of the progress of Cases, including in Courts
- Reduce manual and redundant Records keeping

The data is collected from various sources and stored on their server *Fig. 1*. This helps the government to stream line data and have it under one roof. These data sets than can be used efficiently with many combinations by the Police department. The State Data Center (S.D.C.) is a subset of this entire network. Some agencies pull data from the S.D.C. The Strategic Support System also pulls data from the S.D.C.

2.2. Metropolitan Police Data Viz

The Met is committed to transparency and, as such, we wish to give you as many tools as possible to help you to not only see what your local police force is doing to combat crime but also to be able to identify the different types. Also, by being able to see crime stats mapped out, you can be better prepared to protect yourself. *[Met Police U.K. n.d.]*

A similar attempt was made by the U.K. police department. The screenshot of the webpage is on the adjacent page *Fig. 3*. But the data was open for public. They have also used other parallels like use of the Taser gun, stop and search dashboard. The data was categorized

into 9 main categories. They are as follows:

- **Theft and Handling**
- **Violence Against the person**
- **Burglary**
- **Criminal Damage**
- **Drugs**
- **Robbery**
- **Sexual Offences**
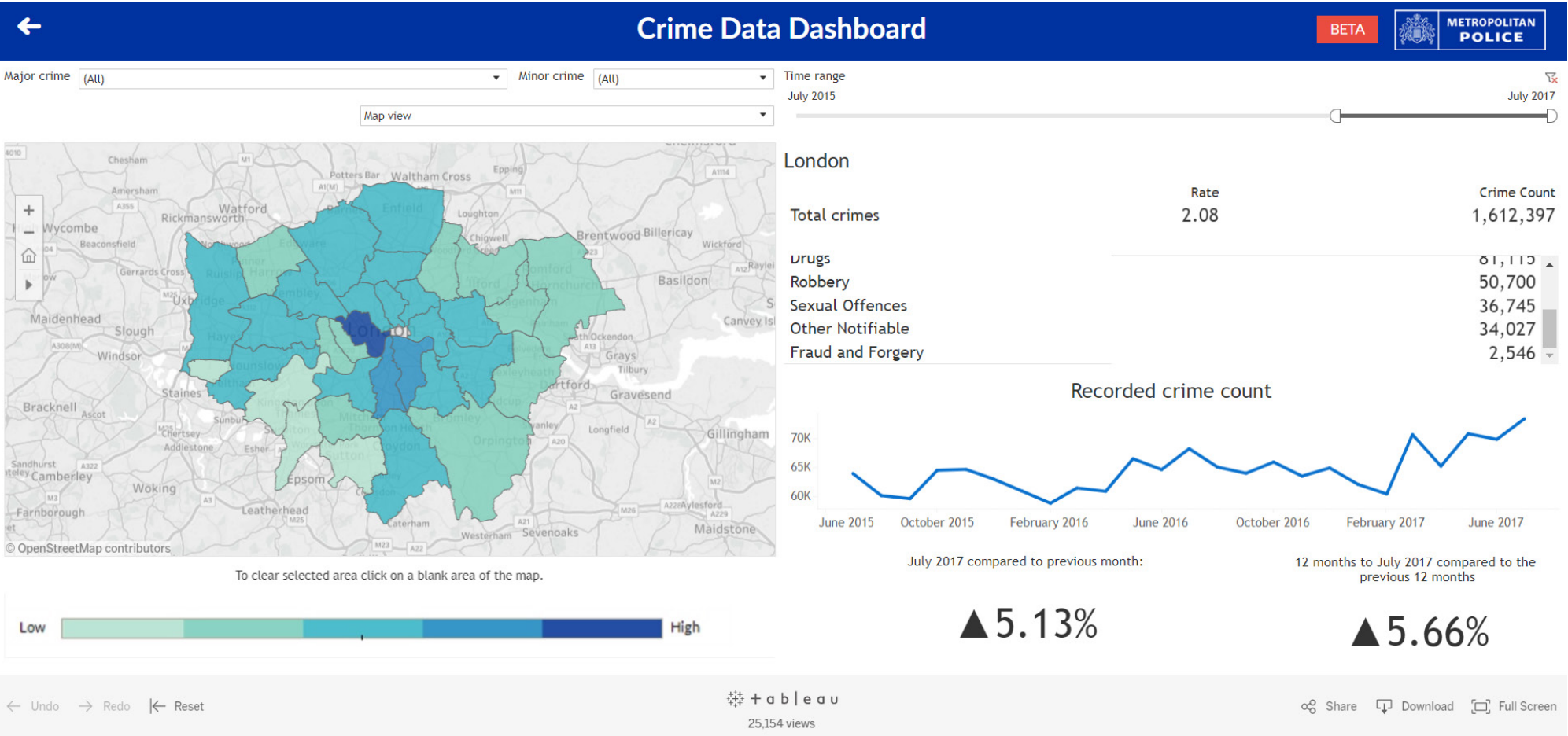- **Other Notifiable**
- **Fraud and Forgery**

The complete list of filters in given in *Fig. 2*. Apart from these filters there is a date filter on the top right *Fig. 3*.

Pros:
As an open data project, it has a lot more reach and function for the users.
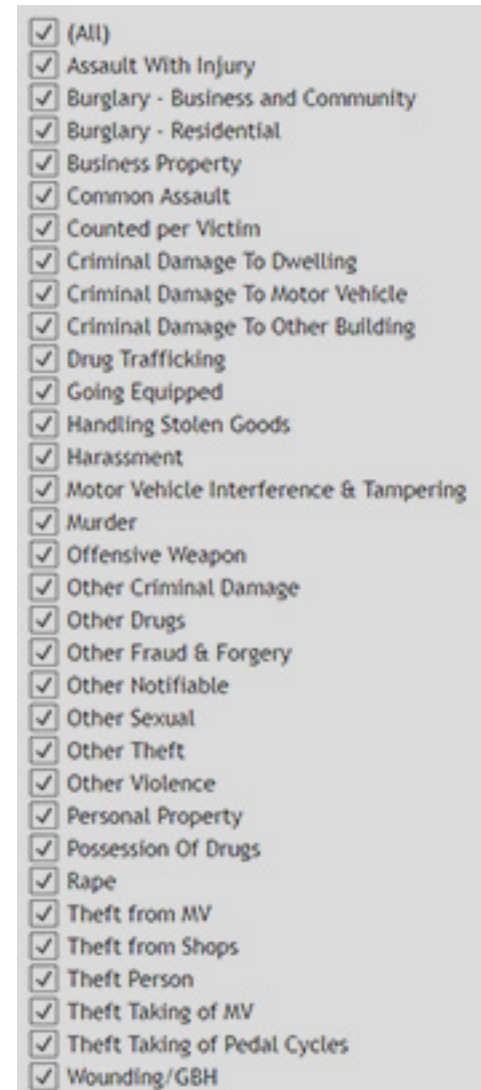
Fig. 2　Full list of filters for MET Crime data

Fig. 3   Metroplitan Crime Data Webpage (Beta)

2.3. Crime Reports U.S.A.

The interactive portal makes it possible to navigate and explore information in more ways, enabling the user with access to layers of it as and when a detailed look is needed.

It is United States largest collection of law enforcement agencies committed to transparency, public access, and citizen engagement. The data on Crime Reports is sent on an hourly, daily, or weekly basis from more than 1000 participating agencies to the Crime Reports map. Each agency controls their data flow to Crime Reports, including how often they send data, which incidents are included, etc.

They have ventured into partnerships with various other agencies for surveillance and crime control. Users can

- **Register a surveillance camera.**
- **Submit a crime tip.**
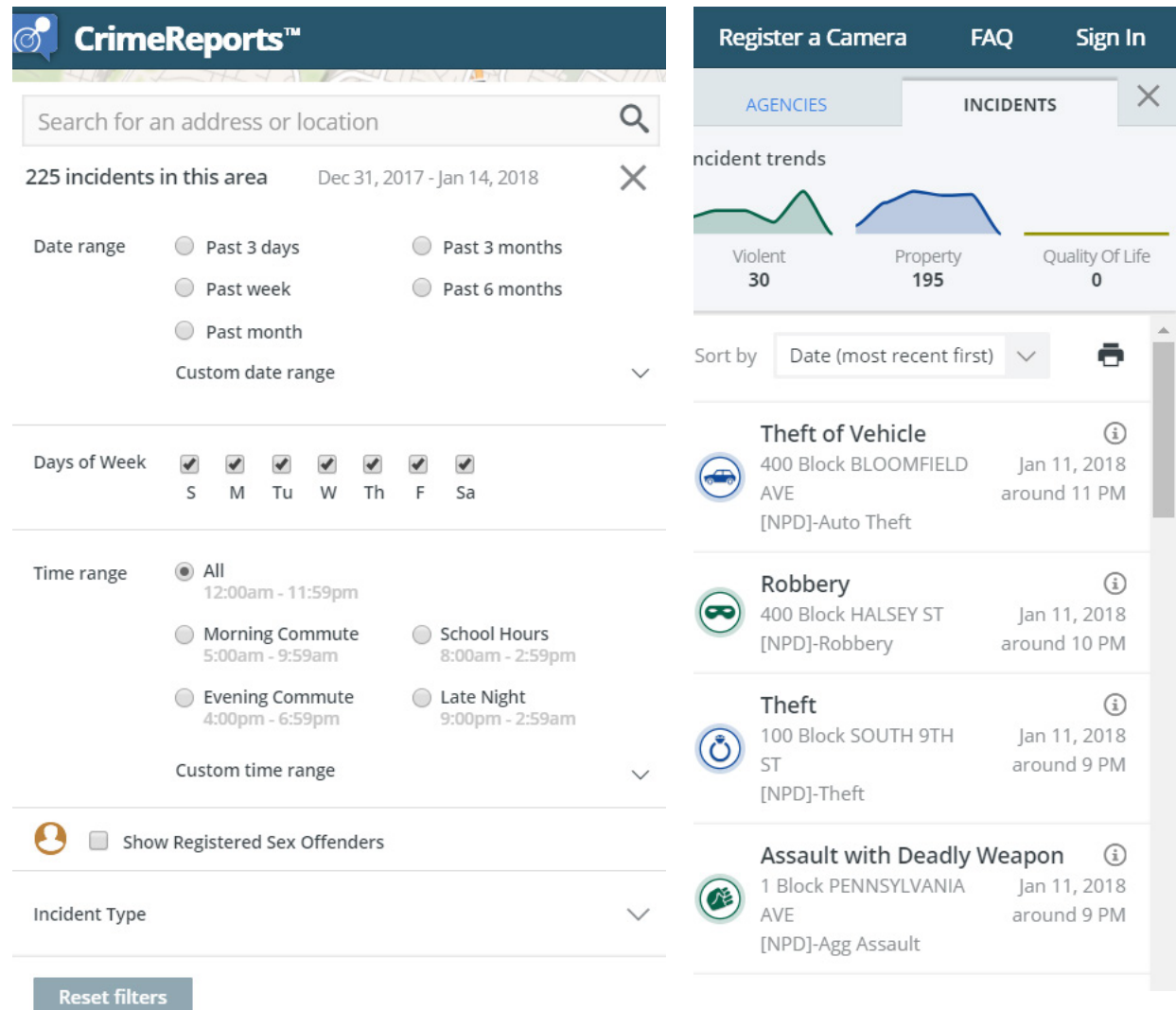- **Data researches (Data submitted to Crime Reports Website).**

Fig. 4   Filters panel on the left and the incidents panel on the right
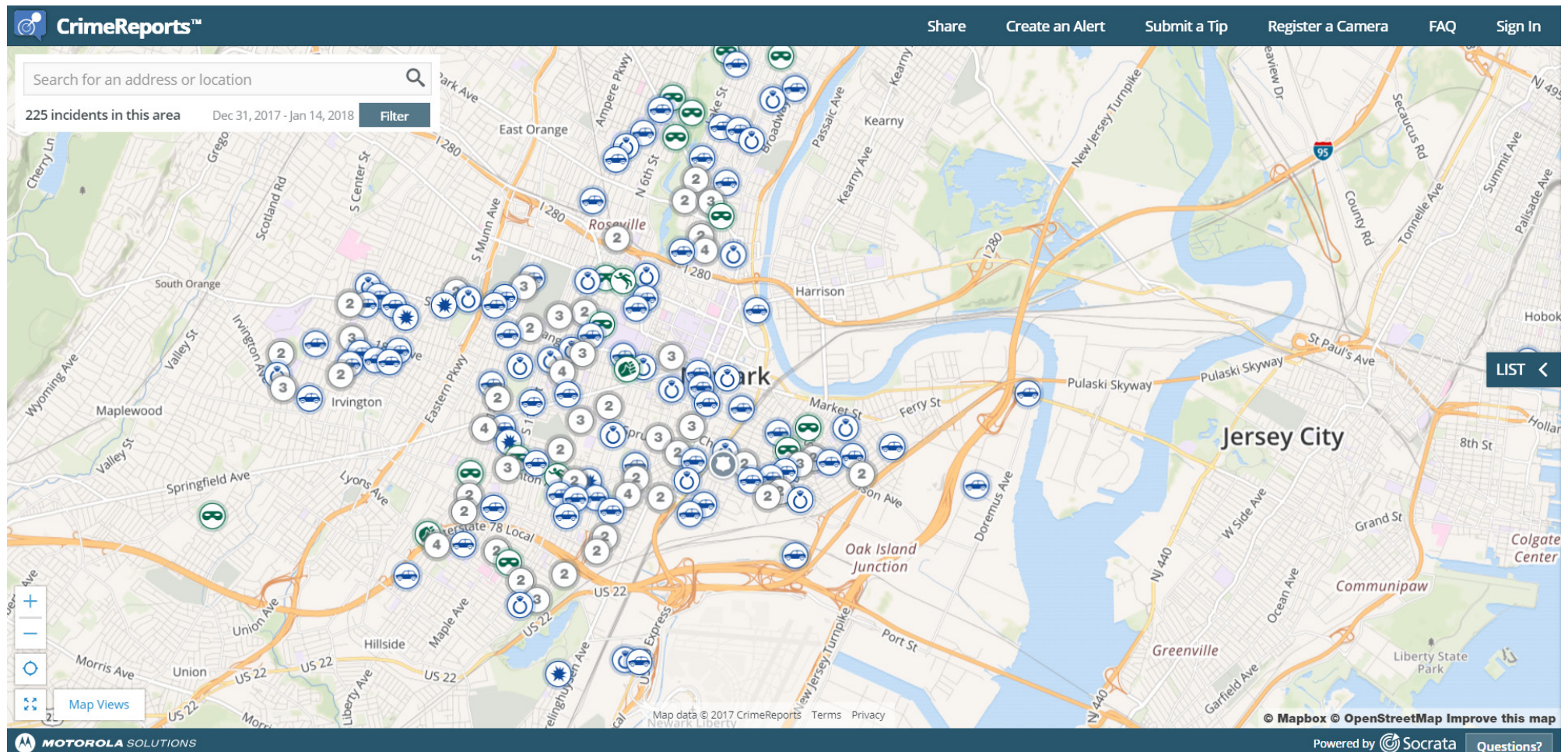
Fig. 5   Crime Reports U.S.A. Webpage

2.4. Existing tools for Crime Data Visualizations

There are various tools available online for data visualizations. Mentioned below are some tools appropriate for crime data visualizations.
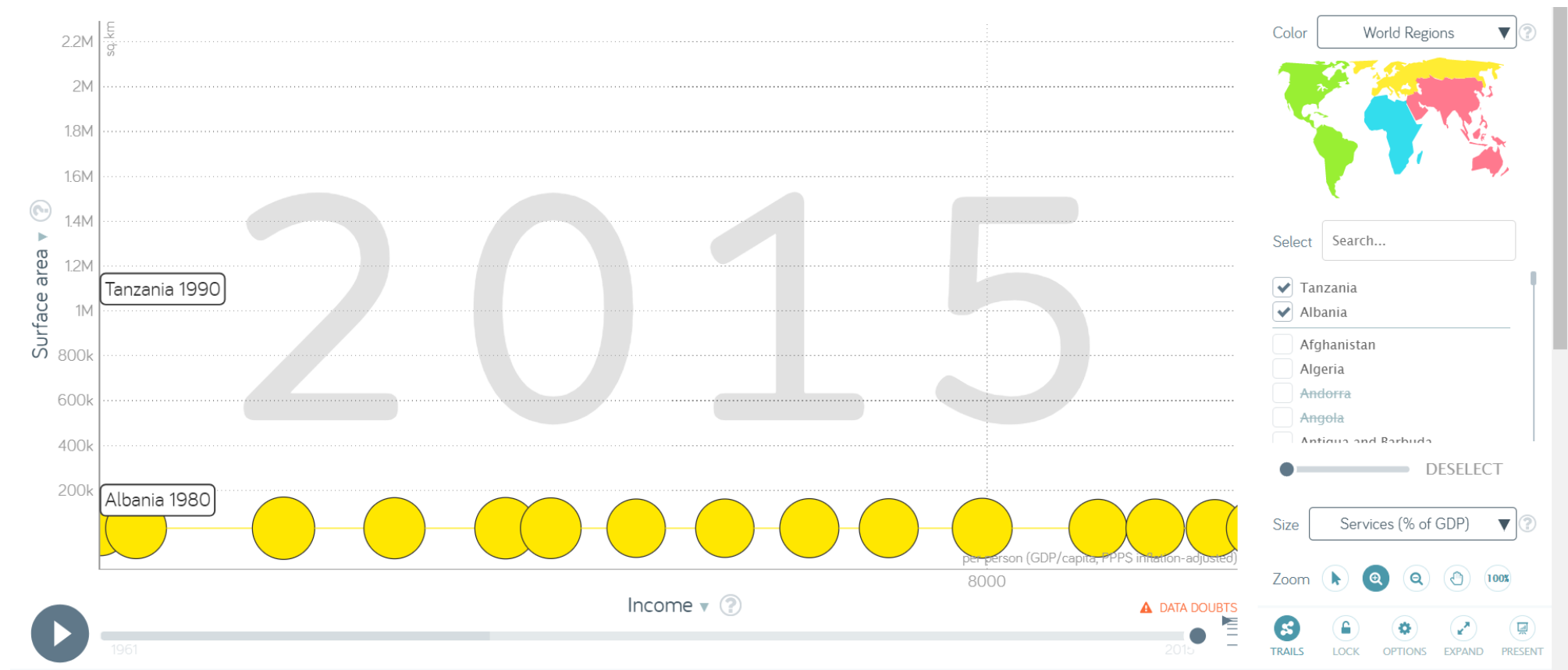

Fig. 6   Gapminder website

2.4.1. Gapminder

This is a tool to help you answer questions about global development using data. Gapminder *Fig. 6* has two free products: Gapminder World, which is available online and Gapminder Desktop, which is a software you can install on your computer. Both tools sit on top of substantial and well-arranged collections of statistics from the World Bank, the United Nations and other international organizations.

Gapminder encourages you to compare different indicators from different countries over time and experiment with various ways of combining datasets. Gapminder's main innovation is the motion chart, which animates how statistics about any issue change over time. Two other neat features are- being able to select and highlight different countries as a way of making comparisons, and flick between viewing chart and world map views of the data.
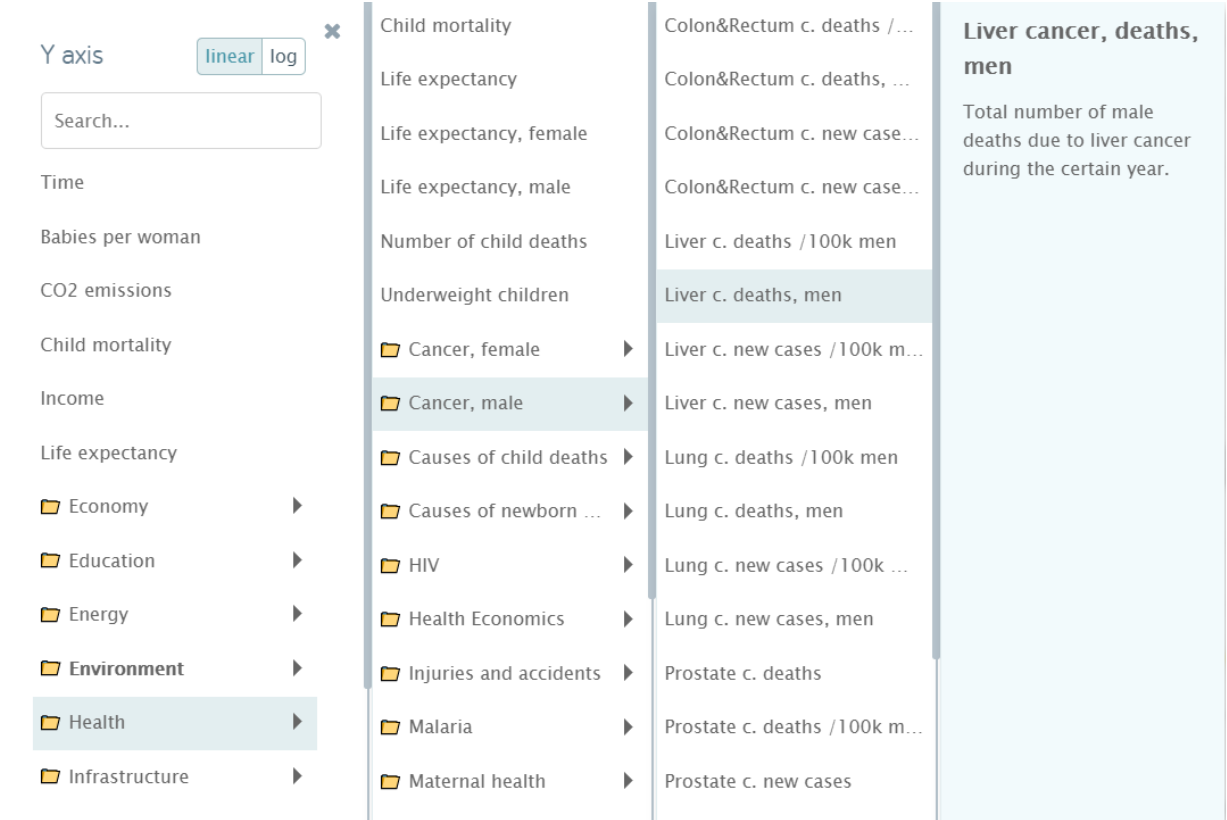

Fig. 7   X - axis filters

2.4.2. Timeline JS

Fig. 8   Timeline Webpage - (Nelson Mandela)

It is an open-source tool that enables anyone to build visually rich, interactive timelines. Beginners can create a timeline using nothing more than a Google spreadsheet, like the one we used for the Timeline above. Experts can use their JSON skills to create custom installations while keeping TimelineJS's core functionality.

- **TimelineJS can pull in media from a variety of sources such as Twitter, Flickr, YouTube, Vimeo, Vine, Dailymotion, Google Maps, Wikipedia, SoundCloud, Document Cloud and more!**

- **It allows to write each event as a part of a larger narrative.**

- **It includes events that build up to major occurrences — not just the major events.**

- **All data shows on a single timeline.**

2.4.3. Tableau

It is a business intelligence (BI) software tool that supports interactive and visual analysis of data. It has an in-memory data engine to accelerate visualization. Tableau has three main products to process large-scale datasets, including Tableau Desktop, Tableau Sever, and Tableau Public. Tableau also embeds Hadoop infrastructure. It uses Hive to structure queries and cache information for in-memory analytics. Caching helps reduce the latency of a Hadoop cluster. Therefore, it can provide an interactive mechanism between users and Big Data applications.
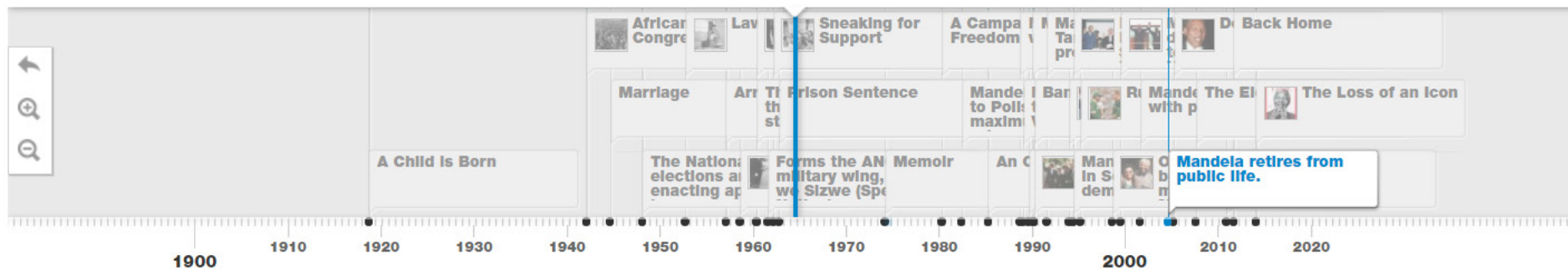

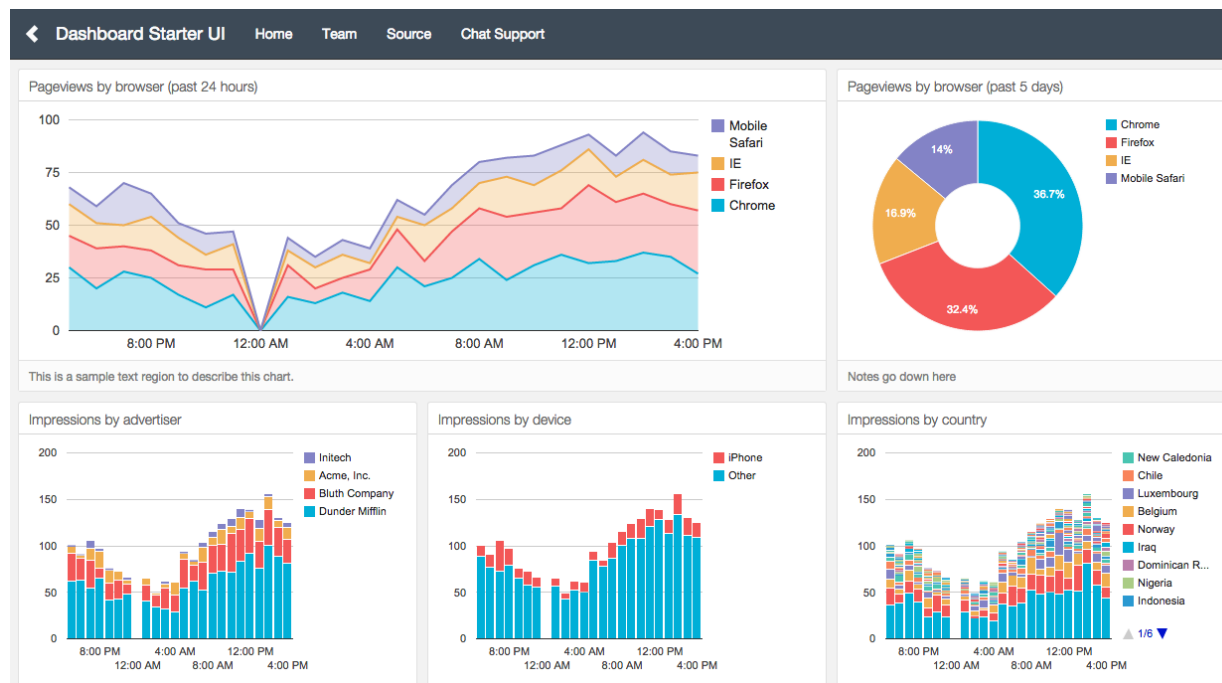*Fig. 9   Showing E.g. of Nelson Mandela's timeline.*

2.5. Dashboard Designs

Dashboards are designed to provide users the maximum amount of information on the first go. The thumb rule of data visualization is to give users an overview of the information and then let the users decide what they want to focus on. The key features / insights should capture more area. The focus of the user should be guided well in terms of flow of the information.

A dashboard is considered good when the user is able to read through the data smoothly and able to draw parallels to the information. A clear mental model of the entire system helps user to understand information much better. Things should not be left un-related. Action to information should be clear.

- **Make the complex simple:**
  When there is lot of dynamic data, that changes all the time and different analytical needs and questions, take out all this complexity and make it simple.

- **Telling a clear story:**
  The ability to connect data to the context and answeing the user's questions makes the dashboard an efficient one.

- **Reveals details as needed:**
  Giving each user what they want to see – no less but also no more. Some users might need to be able to see a more granular view of the data – others could suffice with an overview.

Fig. 10   A dashboard design (Image Source: Github)

Dashboard Design Principles

There are a few principles of data visualization. Incorporating them in the design makes the users tasks easy. They are as follows:

- **Information at a glance:**
  Try and communicate the crux of the information in less than 30 seconds of a glance at the website. Layering information in accordance of the user goals is very essential.

- **The Inverted Pyramid:**
  The most important and substantial information is at the top, followed by the significant details that help you understand the overview above them; and at the bottom you have general and background information, which will contain much more detail and allow the user to dive deeper.

Most Important Data

Second Level Information

Details
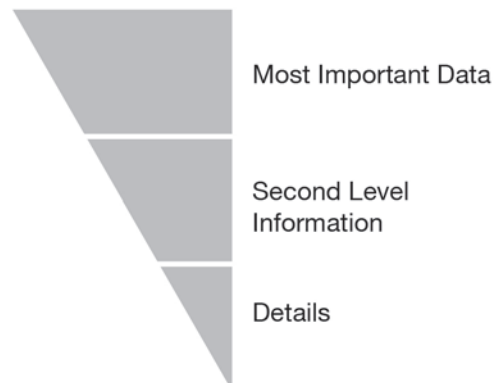
- **Less is More:**
  As we know that the short term memory can memorize or hold only 7(±2) at a time—the amount of items to put in the dashboard. Visual clutter can be avoided by layering the data by using filters and hierarchies. Breaking segments into tabs.

2.6. Visualization Charts

Each chart solves a different problem and has its own pros and cons. To determine which chart is best suited for each of those presentation types, there are a few things to be considered.

- **How many variables are to be shown in a single chart, one, two, three or more?**
- **How many items (data points) are displayed for each variable? Only a few or many?**
- **Will the values be display over a period of time, or among items or groups?**

When these questions and few more are answered, layouts can be explored. Bar charts are good for comparisons, while line charts work better for trends. Scatter plot charts are good for relationships and distributions, but pie charts should be used only for simple compositions — never for comparisons or distributions.

Chart Suggestions—A Thought-Starter

There are plenty of ways to visualize a particular data set. Depending upon the user and your goals choosing the right type of data visualization will enhance the result. Dr. Andrew Abela talks about them in the *Fig. 11*. She has categorized them as follows:

- **Comparison**
- **Composition**
- **Distribution**
- **Relationship**
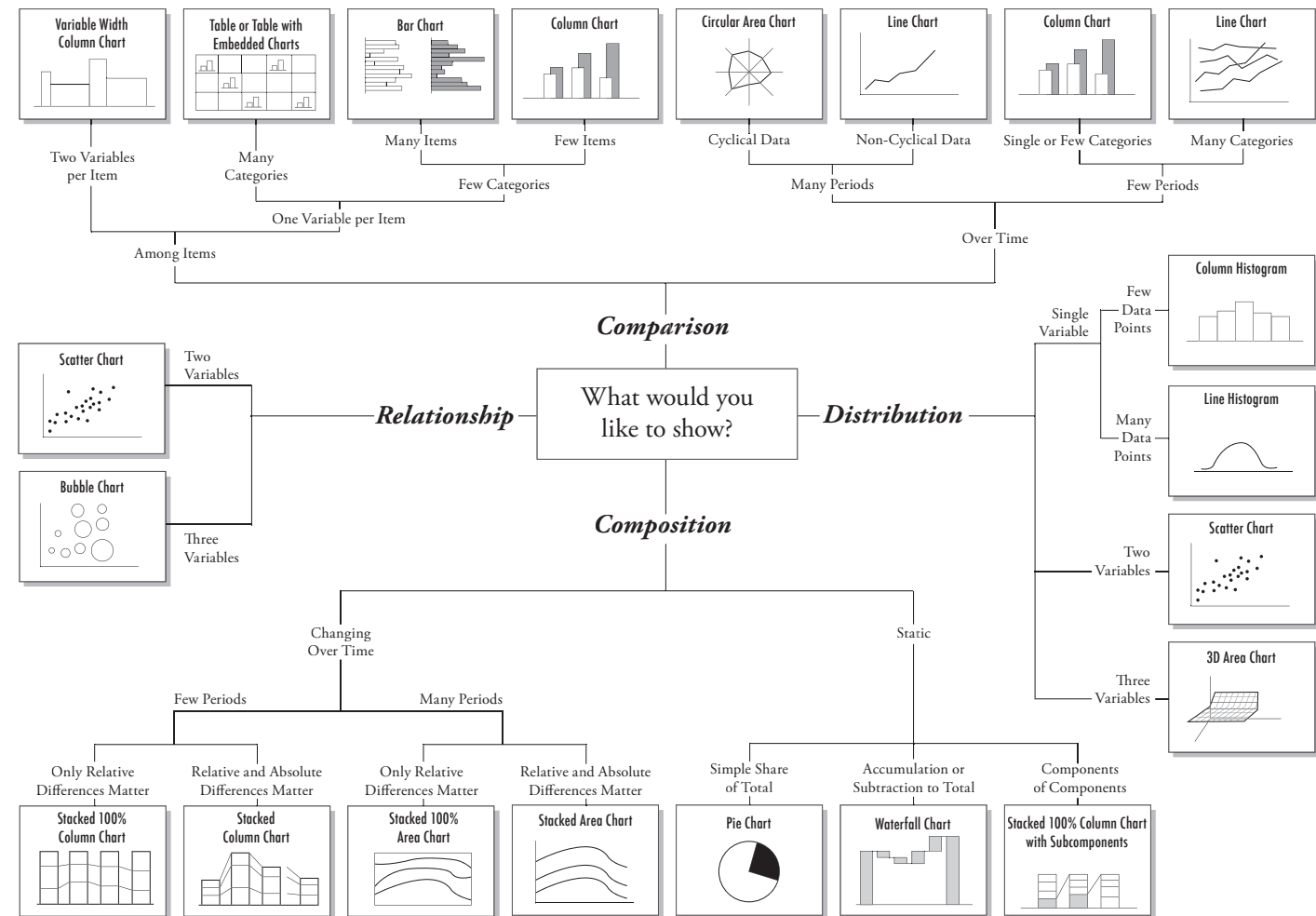
Fig. 11   Dr. Andrew Abela's categorization of visualization charts. (Image Source: https://extremepresentation.com/about/)
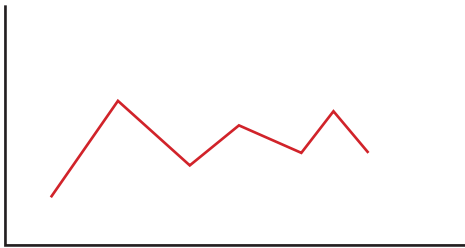
Line Charts

They are great when it comes to displaying patterns of change across a continuum. They are compact, clear and precise. Line charts format is common and familiar to most people so they can easily be analyzed at a glance.
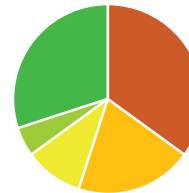
Cons:

Too many lines (variables) can make the chart hard to decipher. You may also find your user constantly referencing the legend to remind them which one they are looking at. If you have too many variables, it's time to consider a second chart.

Bar Charts
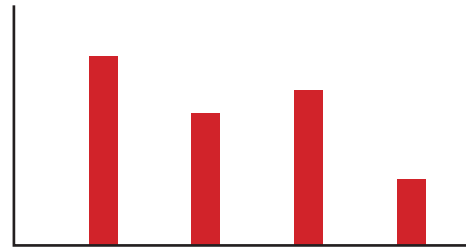
They quickly compare items in the same category. They are easy to understand, clear and compact.
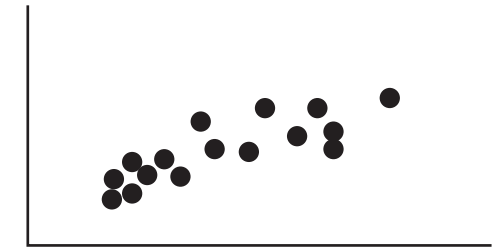
Cons:

Aesthetically speaking, when you have too much data, columns become very thin and ugly. This also leaves little room to properly label your chart. Imagine we had ten different age ranges, per column. Some results, if not most, would be only slivers. To make your chart easy to understand use good colors, proper spacing and a balanced layout. This invites people to look at your chart and even enjoy it. A pretty chart is much nicer way to consume data than squinting at a table.

Pie charts

They rank low in precision because users find it difficult to accurately compare the sizes of the pie slices. The scale resulting in the smallest slices are so small that they even cannot be displayed.
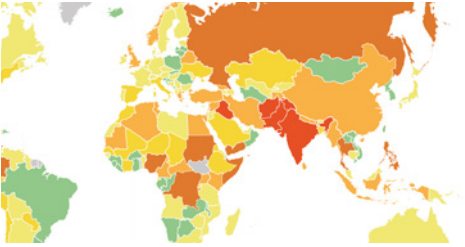
Cons:

Cannot show more than 5-6 variables. After six it is hard for eyes to decipher what are the slices proportion. It also become difficult to label the pie chart. Circles take up space.

Scatterplots

They lack precision and clarity as the relationships between two quantitative measures don't change very frequently. Still, they can be used for an interactive presentation for knowledgeable users.
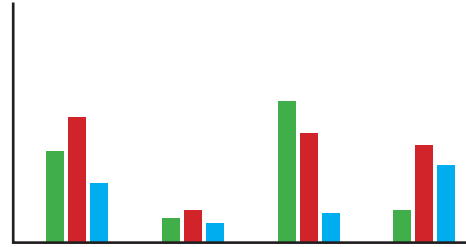
Cons:

Needs huge data sets, does not work with smaller data sets. It also aims at showing a correlation of variables.

Heat Maps

Heat maps are most effective for giving an overview of information. For geospatial data, map is the most optimal data visualization tool.
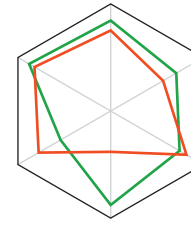
Cons:
Needs a lot of space.

Column Graphs

Good for showing chronological data, such as growth over specific periods, and for comparing data across categories. At a glance, one can compare multiple variables in a single group.
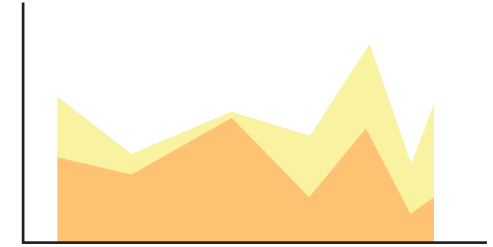
Cons:
Can use for only 4-5 variables accross just 4-5 groups. More the variables and more number of groups, more is the time invested in reading the data.

Spider Chart

Good to show the spread of multiple variable at a glance. The concentration of strengths and weaknesses is evident at a glance.

Cons:
Cannot use it if there are more than 5 values/ variables to compare.

Area Chart

Useful for showing part-to-whole relations, such as showing individual sales reps' contribution to total sales for a year. It helps you analyze both overall and individual trend information.

Cons:
Making sure not using more than 2-3 variables which are not overlapping each other. Not suitable for dynamic data sets.
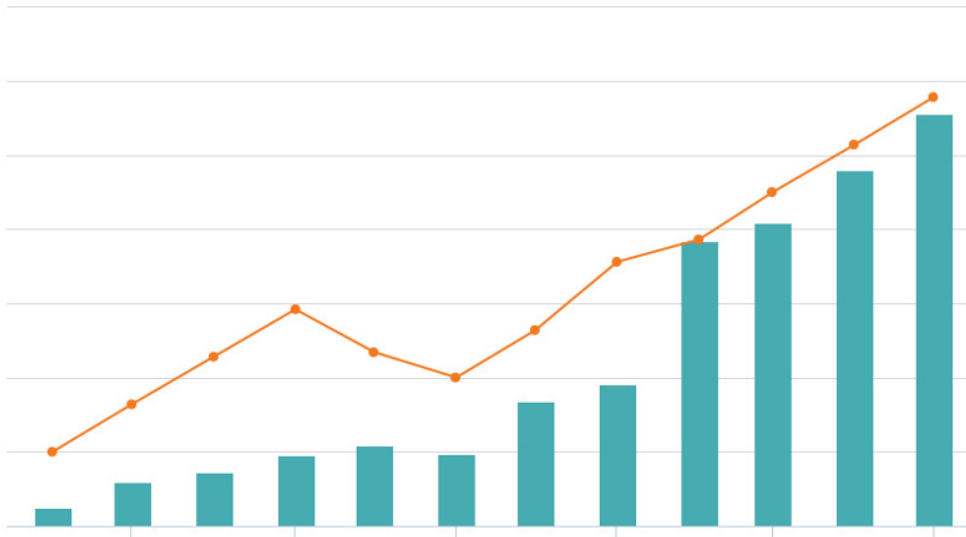
Fig. 12   A merged line chart and a bar chart

There are few more basic visualization charts. Depending on the subject and user goals more interesting ways of reading the data can be brainstormed. Each chart has its own pro's and con's. Depending on what suffices the need of the hour a particular chart is chosen. There are possibilities of merging two charts, for e.g. a line chart can be merged with a column chart as well *Fig. 12*.

Tools for Dashboards

Dashboards are designed to provide users the maximum amount of information on the first go. The thumb rule of data visualization is to give users an overview of the information and then let the users decide what they want to focus on. The key features / insights should capture more area. The focus of the user should be guided well in terms of flow of the information.

A dashboard is considered good when the user is able to read through the data smoothly and able to draw parallels to the information. A clear mental model of the entire system helps user to understand information much better. Things should not be left un-related. Action to information should be clear.

Following are some dashboard design softwares.
- **Tableau**
- **Sage Live**
- **IBM Cognos Analytics**
- **Style Intelligence**
- **SAP - Business Intelligence**
- **Halo**

* Some of them are paid softwares.

3. Primary Research

3.1. Overview

The Maharashtra Police department is divided into multiple different departments like Crime Investigation Department (C.I.D.), Railway Police Force (R.P.F.), Administration, Training, State Intelligence Department (S.I.D.), Anti-Terrisom Squad (A.T.S.) and other 13 departments. The Strategy Support System is the responsibility of Administration department. The Administration department takes care of smooth functioning of the Police department. The need of this tool was realized during the department planning / strategy meetings. The process to collect data for preparation of meetings followed before this was too time consuming and inaccurate. The ranks of the Maharashtra Police department are shown in *Fig. 13*. The marked ranks are the immediate users of the S.S.S. These officials during the strategy meetings decide on the various plans ahead.
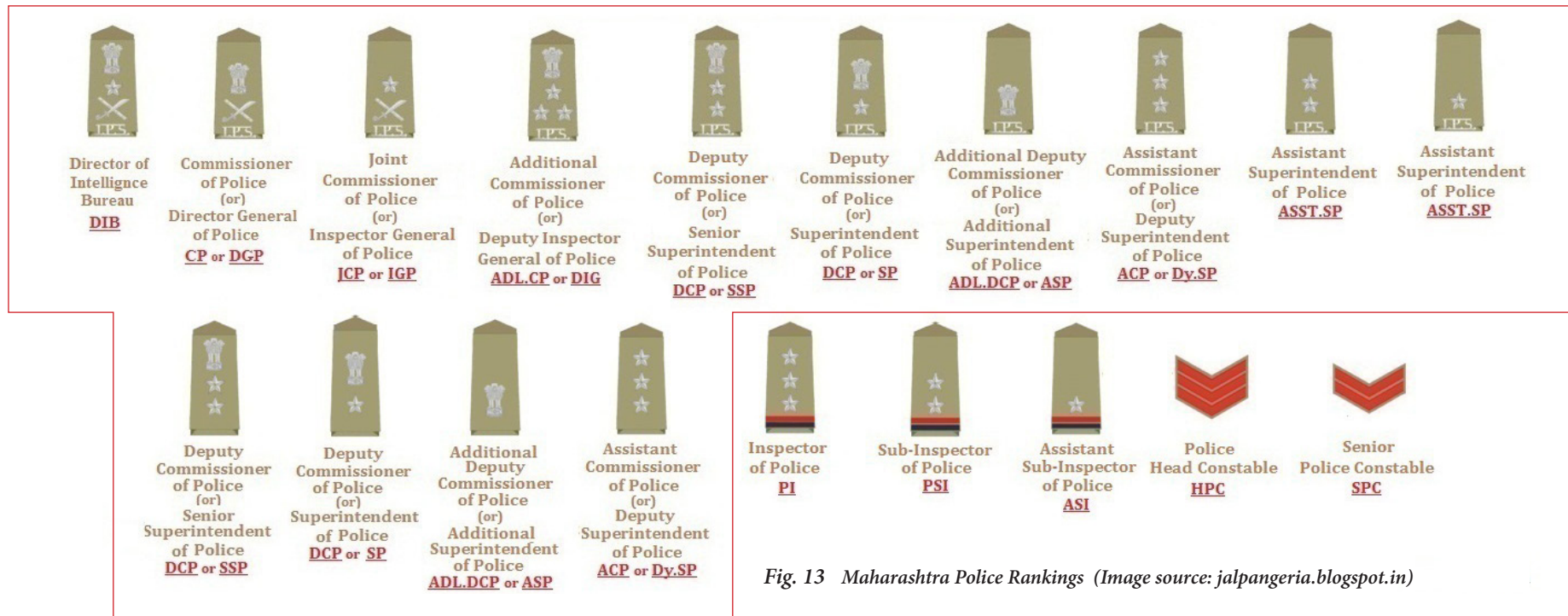

Fig. 13   Maharashtra Police Rankings (Image source: jalpangeria.blogspot.in)

3.2. Police Hierarchy

The hierarchy is strictly followed in government organizations. During any strategic / non-strategic meeting the higher ranking officials ask the lower ranking officials for data a particular data set. The lower ranking official in this is the Superintendent of Police (S.P.) then orders his / her P.A. or his jurisdiction police stations to gather information and provide them. This takes a couple of days as data has to be gathered from various police stations and then compiled according to the need of the higher ranking official. If the data set has to be seen with different parameters than it takes a while to arrange these data sets as they are either manual records or not formatted.
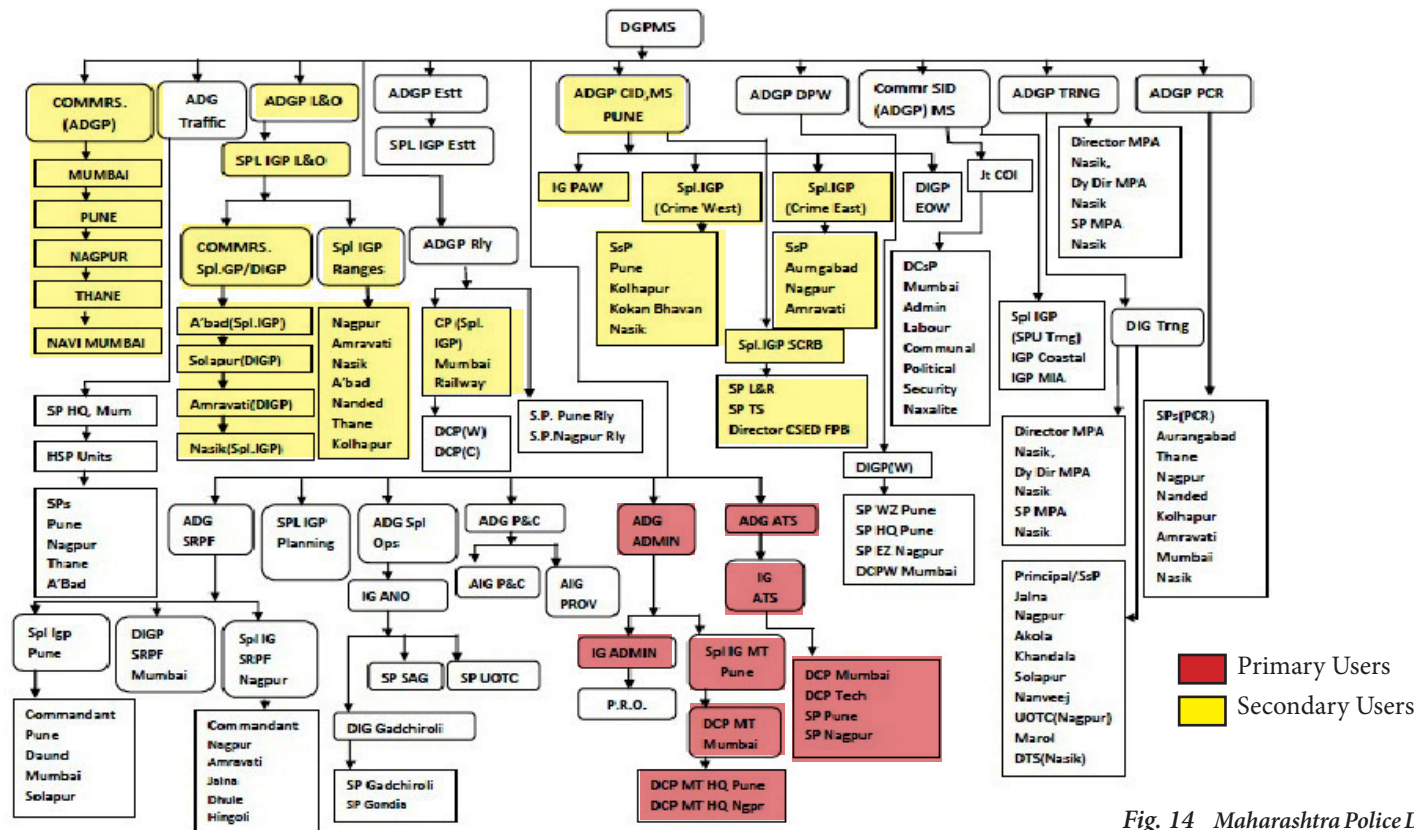

Fig. 14   Maharashtra Police Department Hierarchy (Image Source: mahapolice.gov.in)

3.3. Strategy Support System (S.S.S.)

The strategy support system is an online tool to visualize the Maharashtra crime data sets and also other parallels like motorcade of police, revenue, railway cases, etc. of which the data is pulled directly from the State Data Center.

Considering the S.S.S. and its architecture it is crucial to understand that the cases being registered (F.I.R.) are at the first level. A given information might not be authentic. Hence only certain data can be pulled on initial level.

The *Fig. 15* shows the entire F.I.R. report which the detailed description of the offence and various other details about the victim. This entire data is stored in N.C.R.B. (National Crime Records Bureau). But while the data is pulled from the S.D.C. it only pulls the following variables:

- **F.I.R. no.**
- **Date**
- **Time**
- **Range, District and Zone**
- **Acts & Sections**

3.3.1. M.R.S.A.C.

The Maharashtra Remote Sensing Application Centre was established in September 1988 at Nagpur as an autonomous Organization under the administrative control of Department of Planning, Government of Maharashtra. It is a premier institution to offer benefits of Remote Sensing and Geographic Information System (GIS) Technologies to the State. It provides the map integration for the S.S.S. The geospatial information and the development of the entire system is being handled by them.

Fig. 15 AnF.I.R.copy

3.3.2. System Flow

The *Fig. 16* shows the system flow diagram of the Strategy Support System. The process is divided into 4 major parts. The crime taking place, the crime being reported, the data being stored on cloud and the S.S.S. pulling data from the cloud.

A crime takes palce → Crime is reported at the police station → It is recorded in the station diary and an F.I.R. is filed → Online record → Data is stored in N.C.R.B. & State Data Center

Offline report (Station Diary)

Data is pulled in every **6** hours

.xml
Web service

S.S.S.
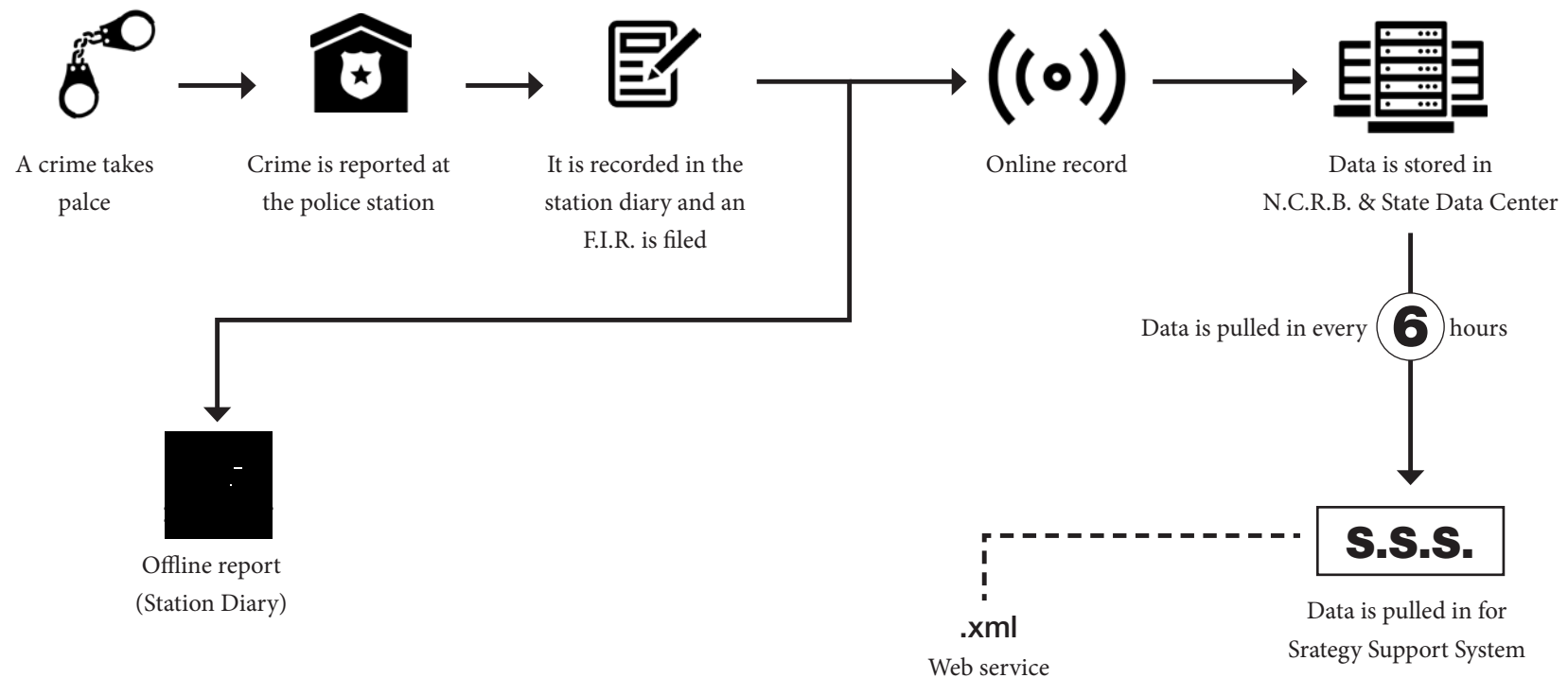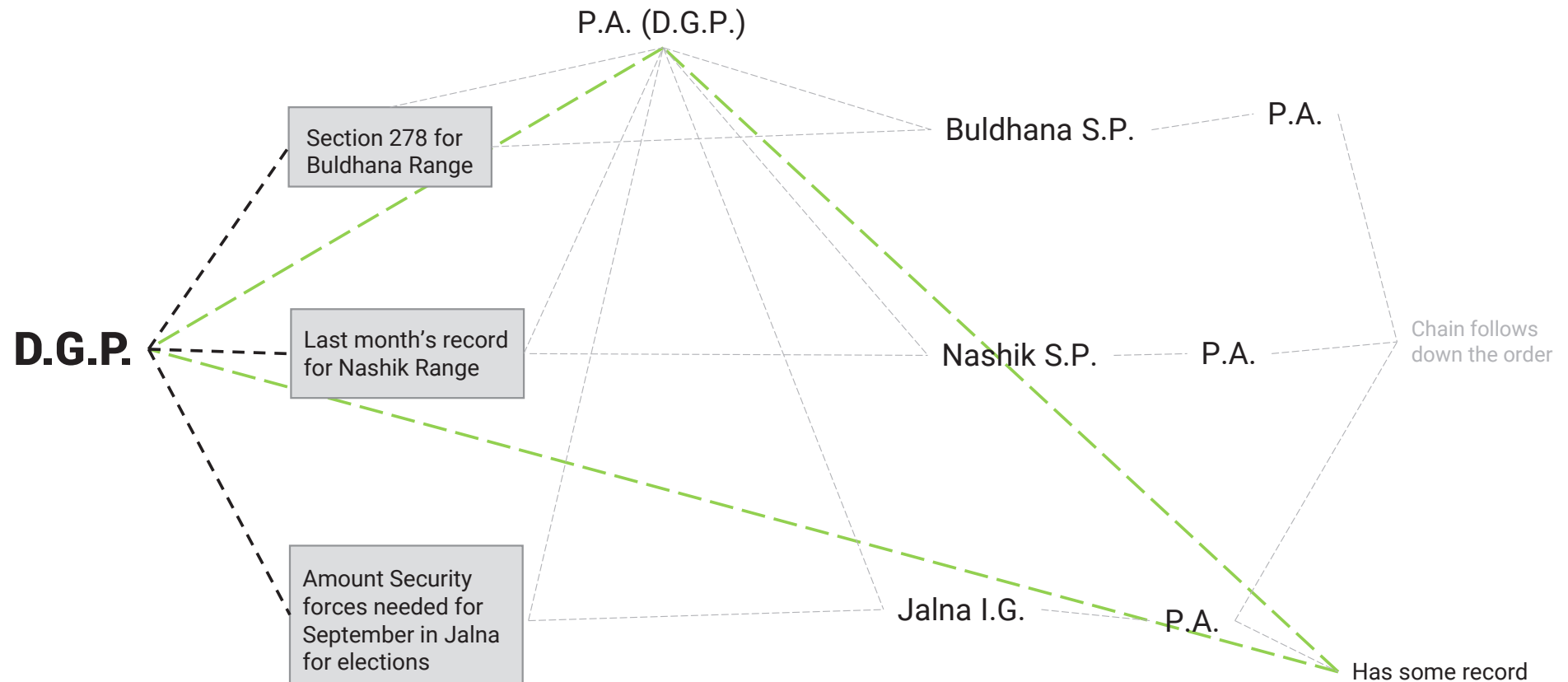Data is pulled in for Srategy Support System

Fig. 16   System flow for S.S.S.

3.3.3. Use case scenario

Time consuming & Inaccurate

Fig. 17   Work / Information flow of the Maharashtra Police Department.

The *Fig. 17* on the previous page explains the work / information flow of the Maharashtra Police Department. This particular fig represents a use case scenario where the D.G.P. wants to see data sets for few particular regions.

For e.g. The first thing he /she wants to see is how many section 278 charges have been registered in the Buldhana range. In this case D.G.P.'s personal assistant is informed about this and they contact Buldhana's S.P. or them directly. The S.P. then orders the personal assistant to get these details from the zones that fall under him. Similarly the chain follows down the order till the local police station. They get back with the collected / documented data sets and it follows the hierarchy. This is one use case. The other e.g. is Nashik range data set. Consider the time taken to gather various other data sets from various other ranges / districts / zones.

This causes delay in terms of quick decision making in case of an emergency. These data sets even if recorded on time and sent across to the highest authority, gaining insights from these data sets becomes a task even for the authorities and they need to assign people to draw insights from them.

When drawing insights / understanding data sets, quick filtering of information and fluidity of data sets helps in looking at different aspects of it. If on paper it increase the effort of the person deriving insights and restricts the user to draw more insights or look at it in a different perspective.

The police stations do submit the data sets periodically but as the entire system was manual or offline, this lengthy process involves a lot of time and effort in data collection, storage and retrieval process.
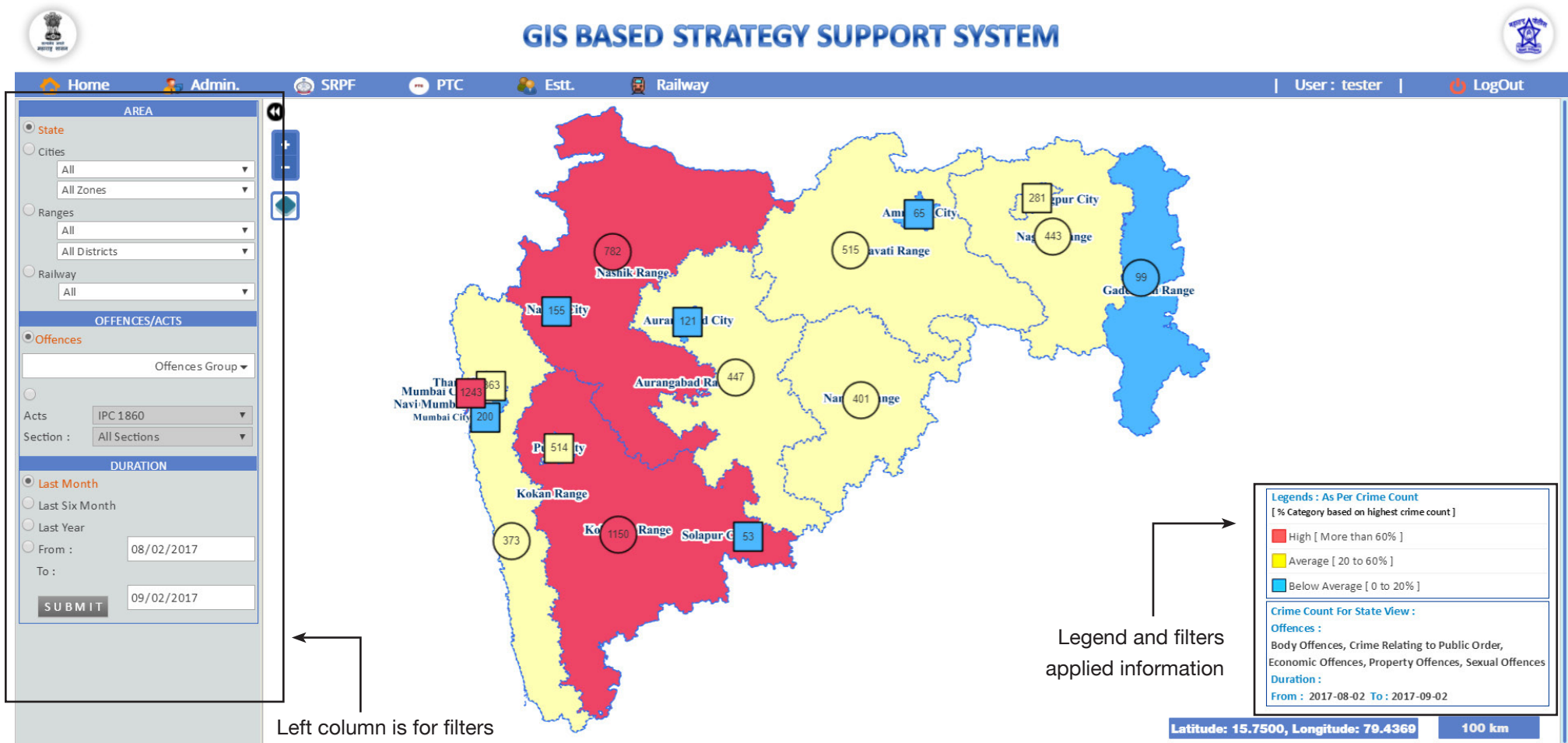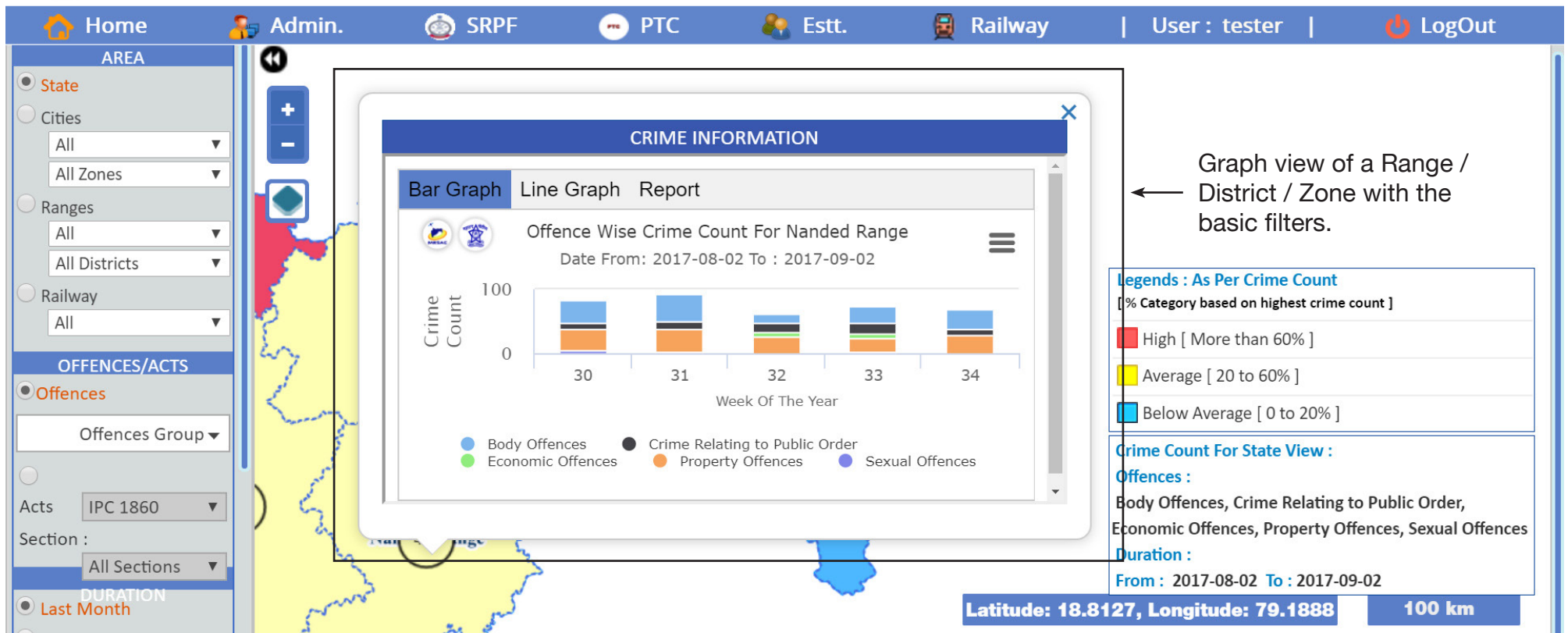
3.3.4. Working screens of S.S.S.

Fig. 18 *Landing screen of S.S.S.*

GIS BASED STRATEGY SUPPORT SYSTEM

| Home | Admin. | SRPF | PTC | Estt. | Railway | | User : tester | | LogOut |

AREA
- ◉ State
- ○ Cities
  - [All ▼]
  - [All Zones ▼]
- ○ Ranges
  - [All ▼]
  - [All Districts ▼]
- ○ Railway
  - [All ▼]

OFFENCES/ACTS
- ◉ Offences
  - [Offences Group ▼]
- ○
- Acts [IPC 1860 ▼]
- Section :
  - [All Sections ▼]

DURATION
- ◉ Last Month
- ○ Last Six Month

Graph view of a Range / District / Zone with the basic filters.

CRIME INFORMATION

Bar Graph   Line Graph   Report

Offence Wise Crime Count For Nanded Range
Date From: 2017-08-02 To : 2017-09-02

Crime Count

100

0

30   31   32   33   34

Week Of The Year

- ● Body Offences
- ● Economic Offences
- ● Crime Relating to Public Order
- ● Property Offences
- ● Sexual Offences

Legends : As Per Crime Count
[% Category based on highest crime count]

- 🟥 High [More than 60%]
- 🟨 Average [20 to 60%]
- 🟦 Below Average [0 to 20%]

Crime Count For State View :
Offences :
Body Offences, Crime Relating to Public Order, Economic Offences, Property Offences, Sexual Offences
Duration :
From : 2017-08-02 To : 2017-09-02

Latitude: 18.8127, Longitude: 79.1888   100 km

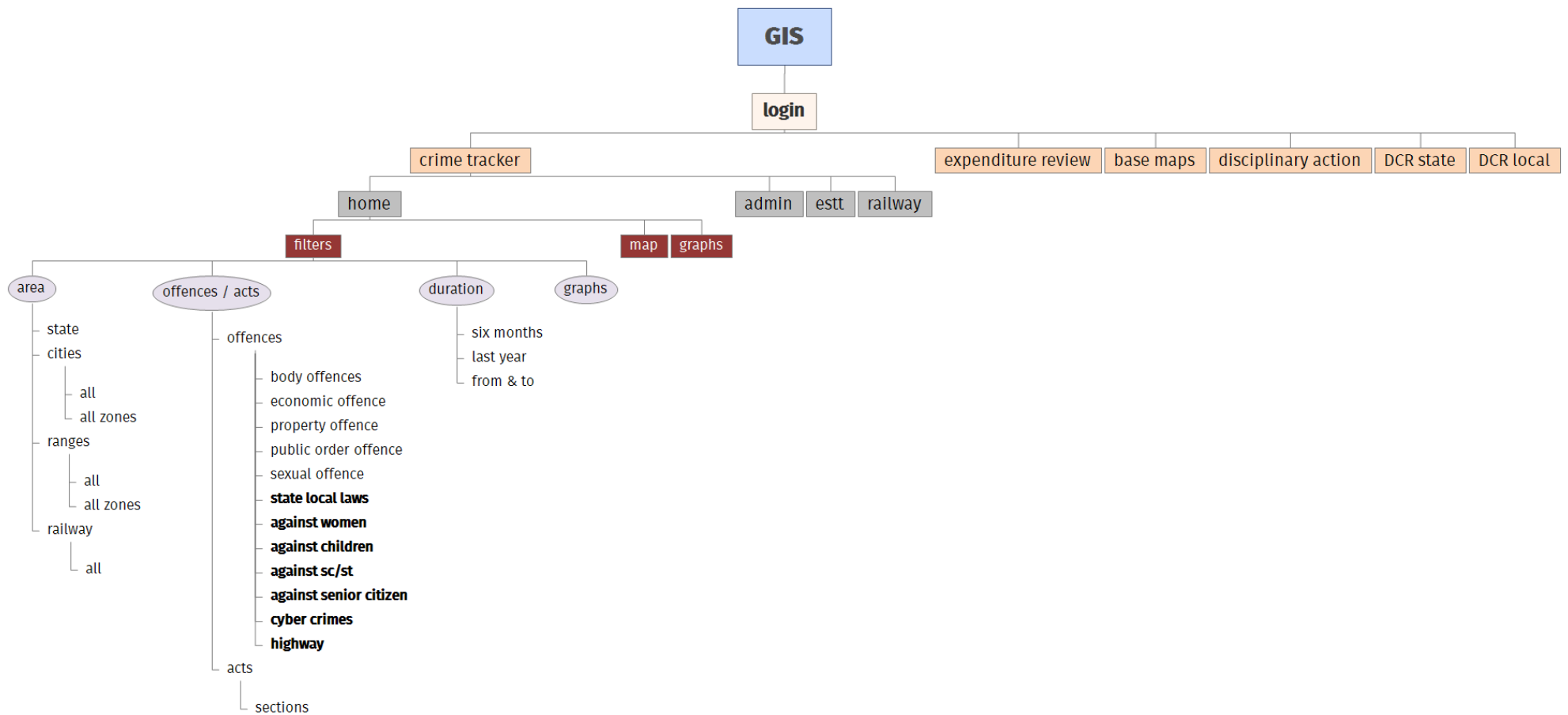## 3.3.5. System Architecture

Fig. 19 S.S.S. architecture

4. Problem Statement

To **navigate** intuitively within the
dashboard and to **encourage** users to
engage with the data sets.

5. Design

5.1. User goals

The design process started with the following user goals.

User goals:

- Navigate intuitively
- Encourage them to engage with the data sets
- Most important information upfront:
- The statistics of Range / District / Zone
- The trend
- Filters

5.2. Layout

Choosing the right elements for the dashboard:

- **Map:**

The most crucial element in the entire strategy system is the map. Hence it also occupies the maximum area in the design.

- **The Bar Graph:**

To give users an overview of all the ranges/ districts/ zone data sets bar graphs work well instead of just numbers.

- **The Trend Graph:**

The line graph shows the trend over the selected time period. It is an important element in terms of predicting or understanding crime.
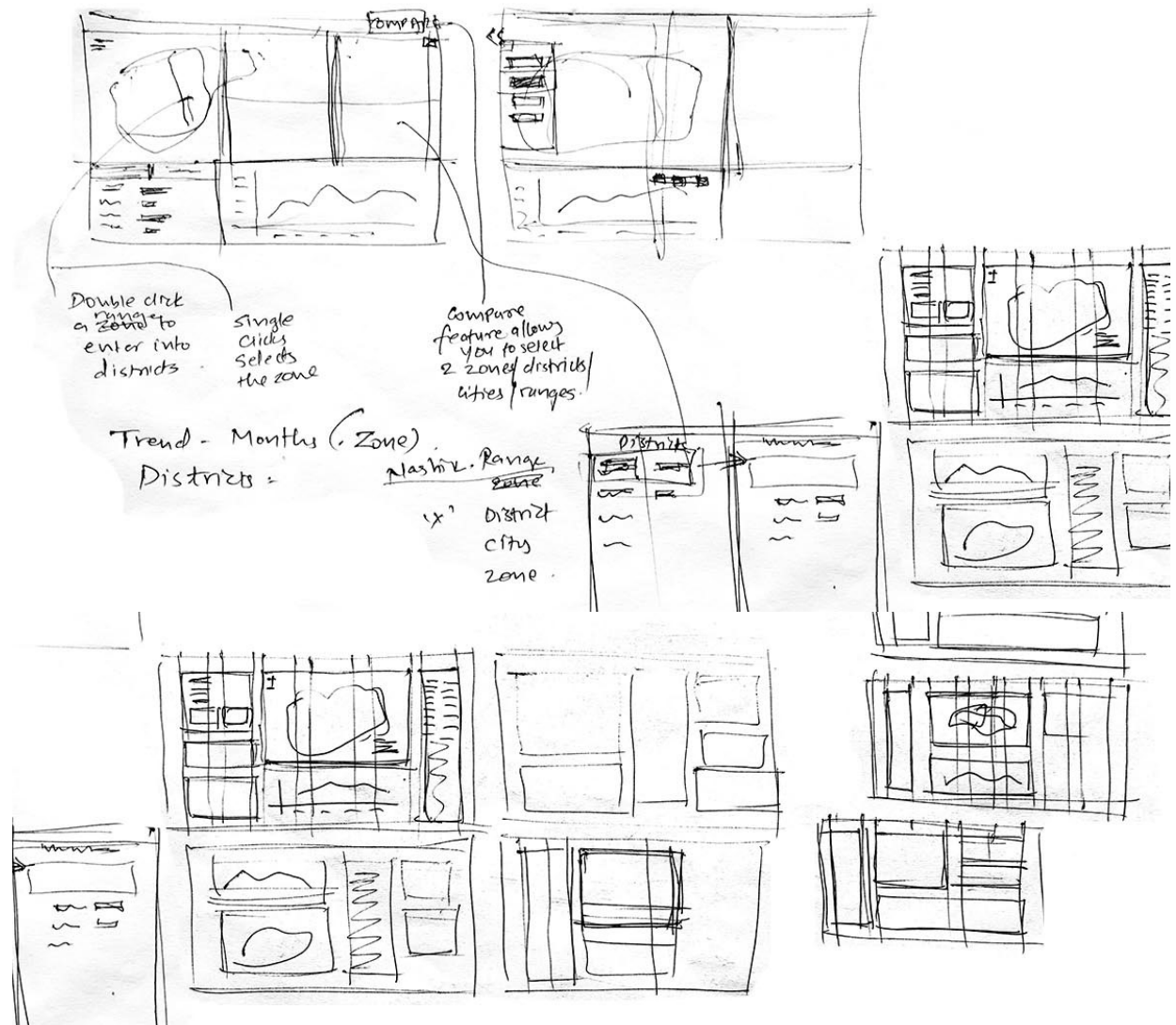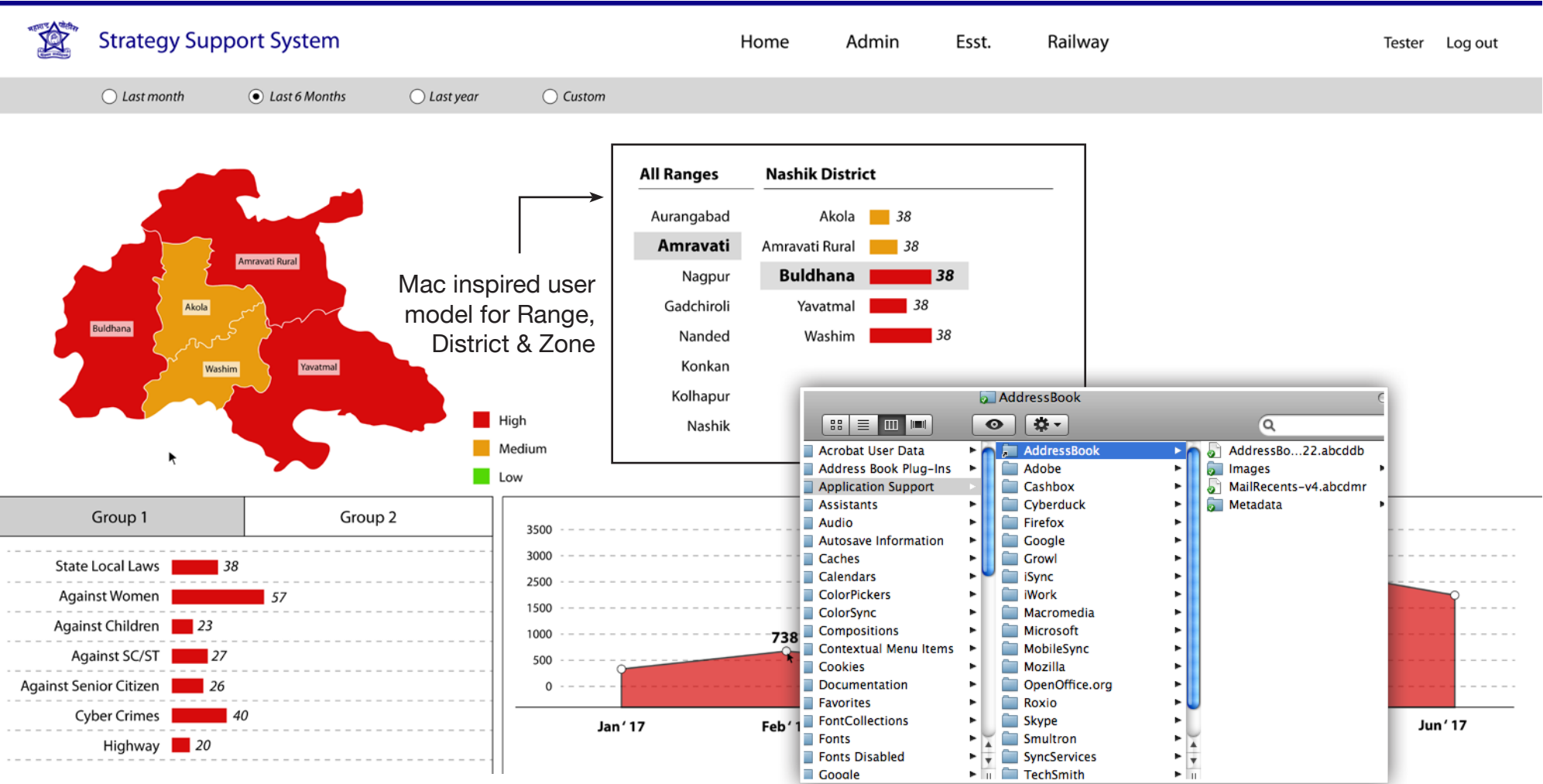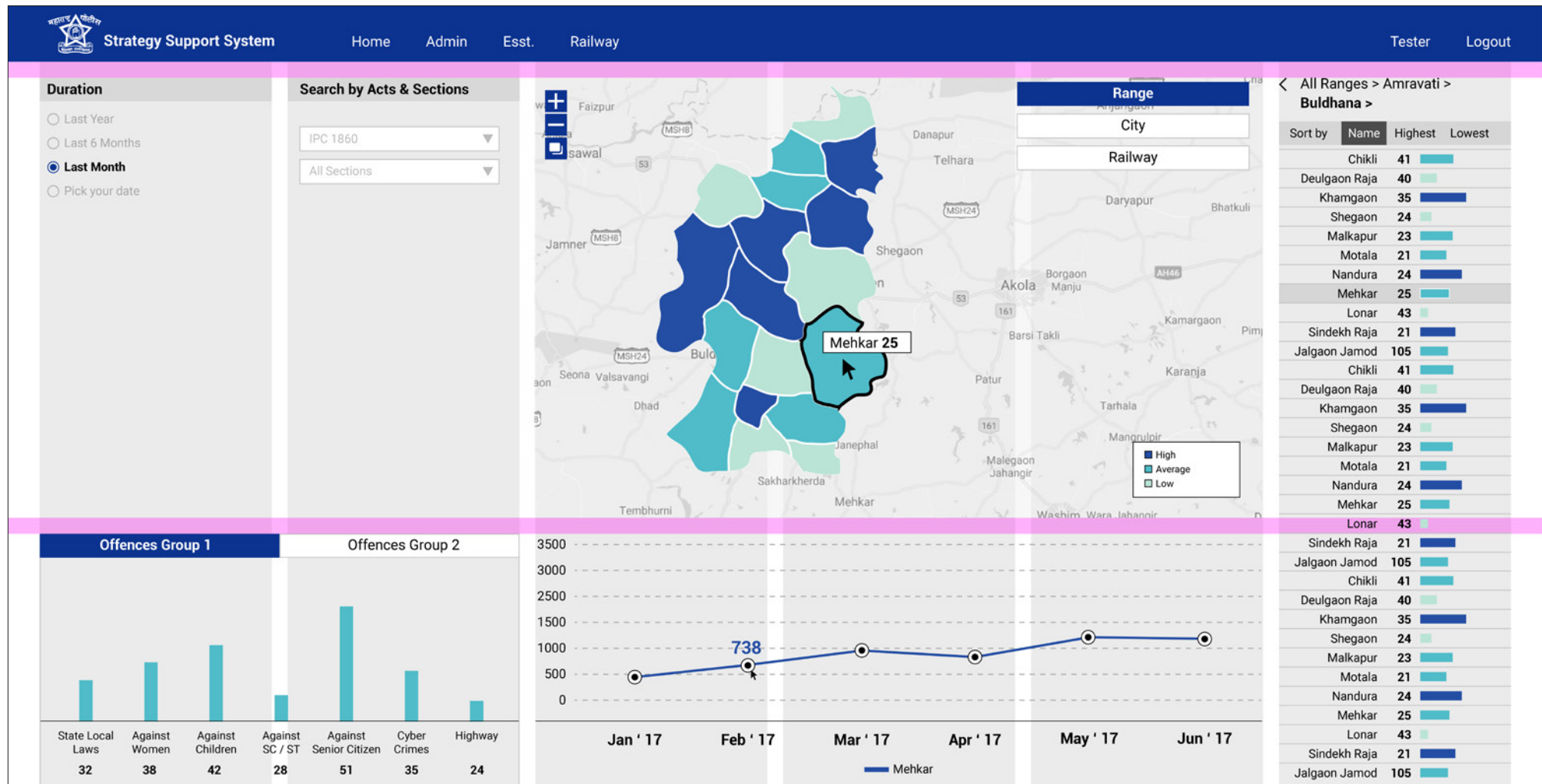

Fig. 20   Few sketches

Strategy Support System

Home   Admin   Esst.   Railway

Tester   Log out

○ Last month   ● Last 6 Months   ○ Last year   ○ Custom

Mac inspired user model for Range, District & Zone

All Ranges	Nashik District		
Aurangabad	Akola		38
Amravati	Amravati Rural		38
Nagpur	**Buldhana**		38
Gadchiroli	Yavatmal		38
Nanded	Washim		38
Konkan			
Kolhapur			
Nashik			

High
Medium
Low

Group 1	Group 2
State Local Laws	38
Against Women	57
Against Children	23
Against SC/ST	27
Against Senior Citizen	26
Cyber Crimes	40
Highway	20

3500
3000
2500
2000
1500
1000
500
0

738

Jan' 17   Feb' 1   Jun' 17

AddressBook

Acrobat User Data	AddressBook	AddressBo...22.abcddb
Address Book Plug-Ins	Adobe	Images
Application Support	Cashbox	MailRecents-v4.abcdmr
Assistants	Cyberduck	Metadata
Audio	Firefox	
Autosave Information	Google	
Caches	Growl	
Calendars	iSync	
ColorPickers	iWork	
ColorSync	Macromedia	
Compositions	Microsoft	
Contextual Menu Items	MobileSync	
Cookies	Mozilla	
Documentation	OpenOffice.org	
Favorites	Roxio	
FontCollections	Skype	
Fonts	Smultron	
Fonts Disabled	SyncServices	
Google	TechSmith	

Fig. 21   Initial Design and layout

Fig. 22   A 6 column grid layout (A)
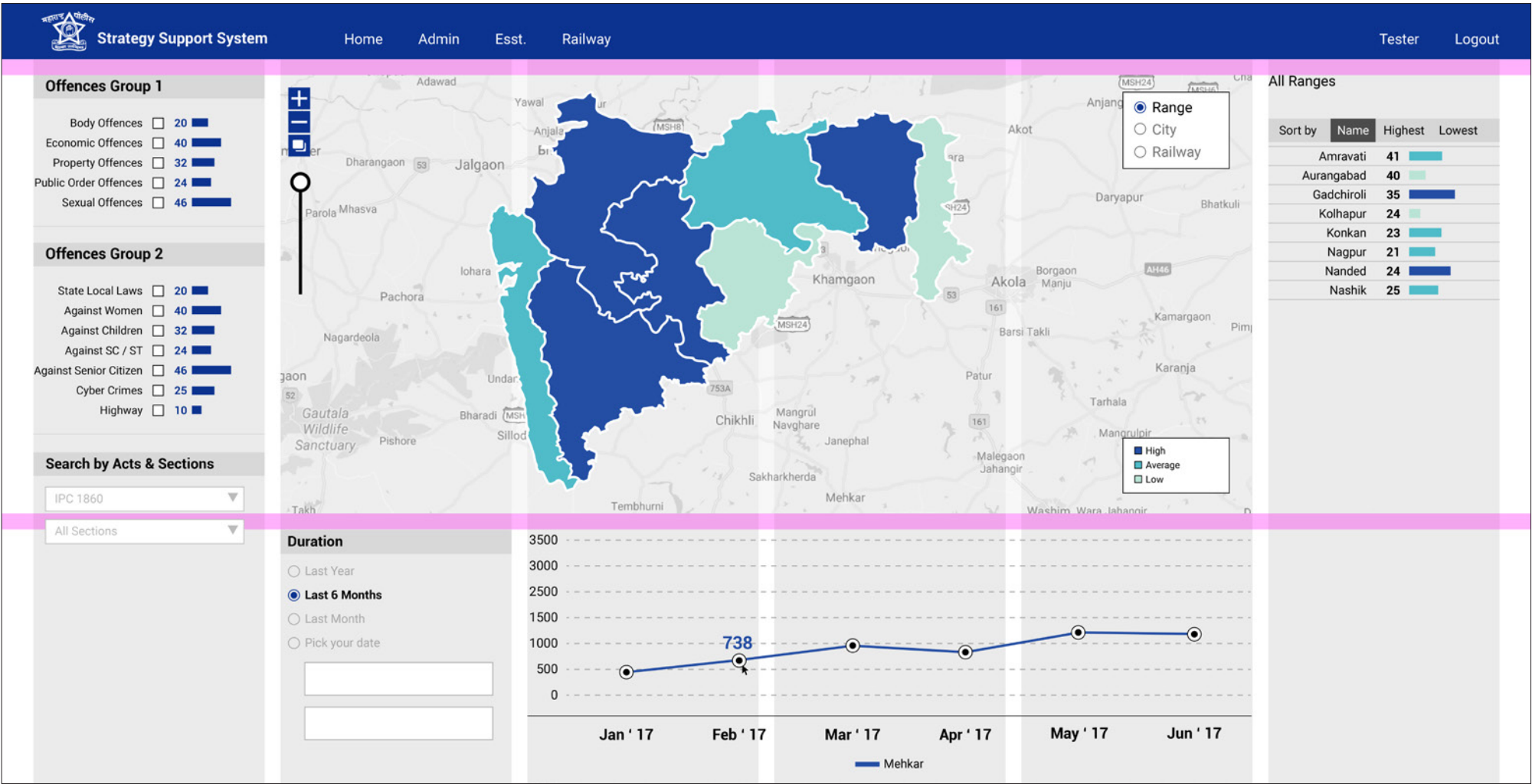
Fig. 23   A 6 column grid layout (B)

5.3. Elements
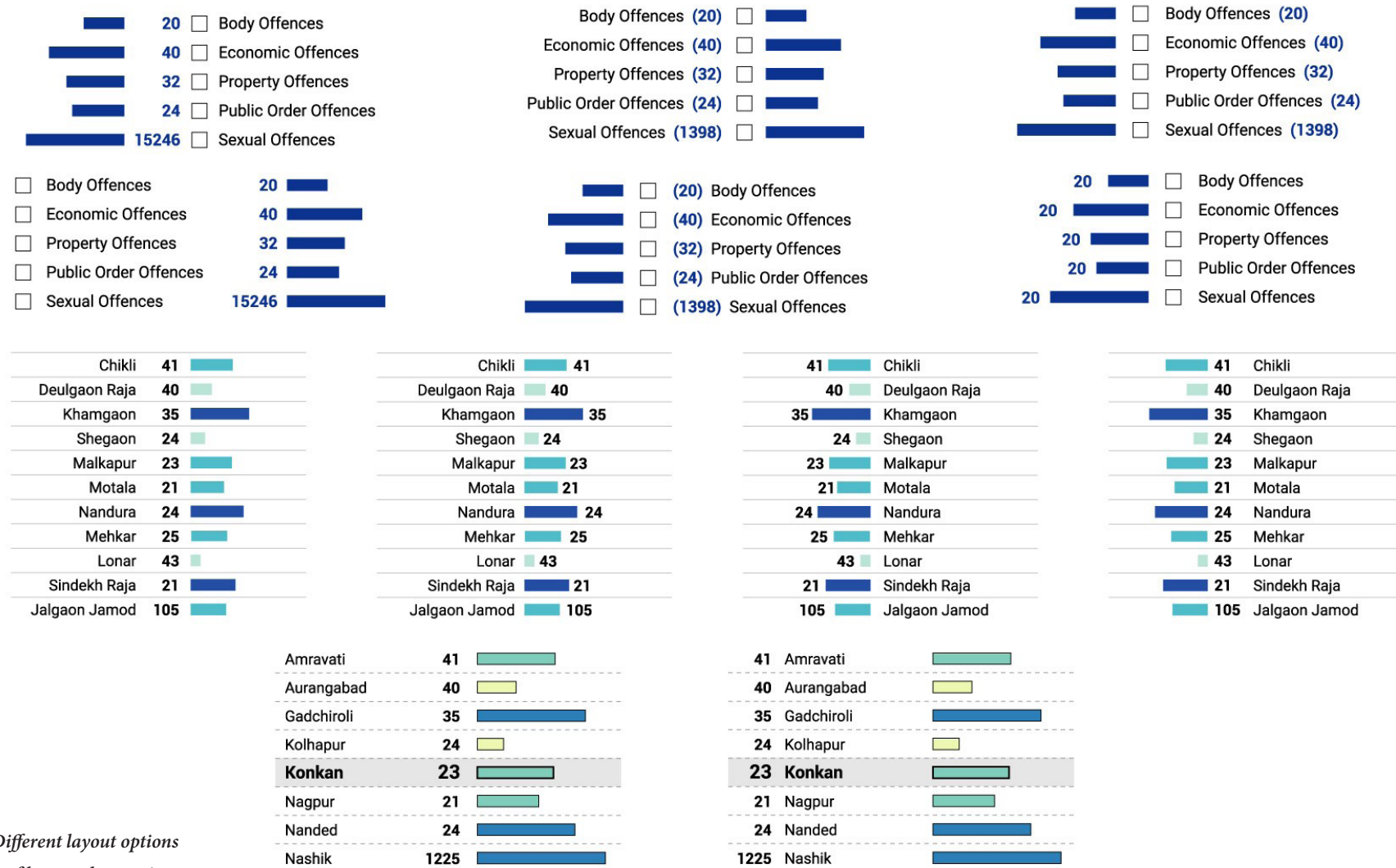
Fig. 24 Different layout options tried for the filters and stats view

5.4. Colour Schemes

A few colour schemes were tried. The colour scheme chosen to represent data on the map was chosen keeping in mind that they were photo-copy safe. Initially Selected colour scheme is marked in *Fig. 25.* But as the gray scale values are completely reversing the scale. The middle and the low values look almost the same, making it difficult to read the heat map in case of a photocopy.

Other options like the blue sequential colour scheme has an equivalent scale in gray colour, but the feedback from the department was to see and alarm the people taking decision on the strategic front and hence red being the high and green as the low.

The final selected colour scheme is tick marked.
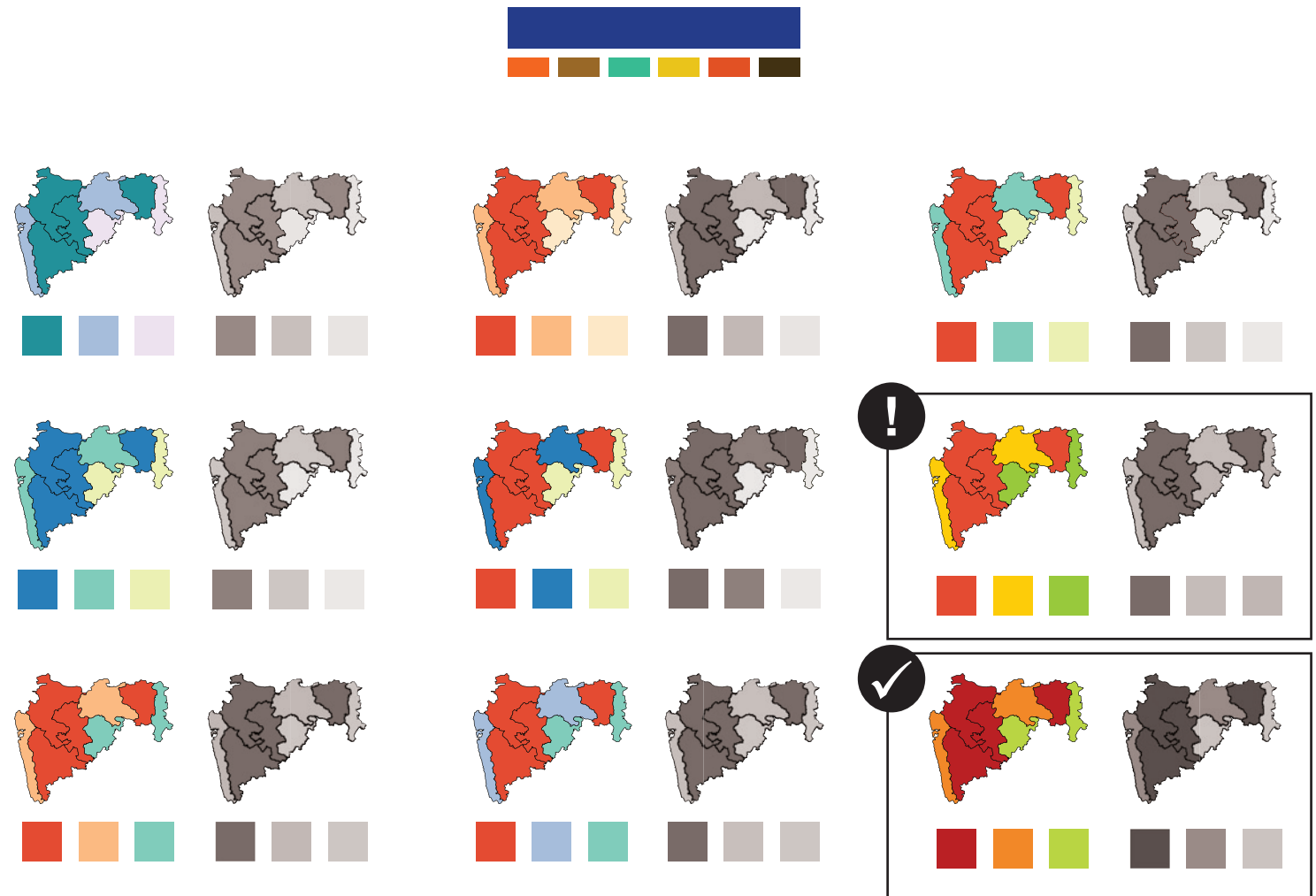
Fig. 25   Tried colour schemes

5.5. Final Design

Major real estate of the dashboard is dedicated to the map as geo-spatial information is the top priority

All range/ district/ zone stats list with numbers and horizontal bar chart for better sorting and quick overview.

Trend chart for quick view over the last few months rise and decline of crime rate.

To search by a particular act or section.

Filters along with numbers and horizontal bar charts revealing maximum information with minimum clicks

6. Evaluation

The evaluation plan is categorized into 3 stages.

- **Exploration:**

The users will spend 5-7 mintues with the dashboard exploring the features. This will be tracked by the mouse tracking software for heat maps. This will provide the necessary information, where users spend most of the time.

Test: Heat Maps

- **Task:**

The users will be handed a multiple choice questionnarie with ten questions in it. They will have to hunt for the information on the dashboard and choose the correct option out of it. This part will give the most crucial data of how they hunt for the information and how much time they take to answer the right question.

Test: Heat Maps, Time taken, Correct answers.

- **Likert Scale:**

The last section would be a likert scale where they will rate the features and design aspects of the dashboard.

Test: Apporpriateness of the features and use of it.

The final sections would be generic comments and feedback section where if they want to write any specific comments.

Exploration	Task followed by Questions	Likert scale
5 mins	5 mins	2 mins
Heat Maps	Quantitative & Heuristic	
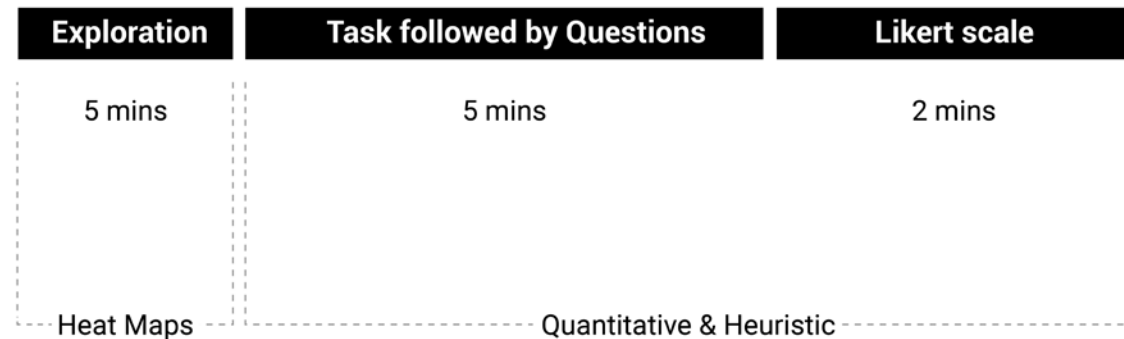
Comments & Feedback

6.1. Statistics

The overall statistics results look satisfying. The tasks given to the users were a success. Only one user failed to find the correct answer for the Question 3 as indicated in *Fig. 30*.

The failure rate has been **5%** with these tested users.
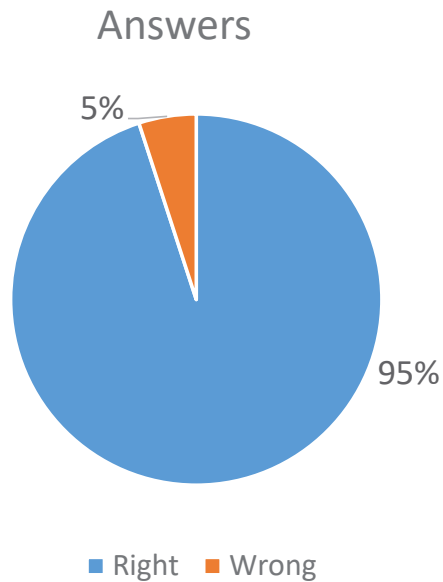
Fig. 26   Pie chart depicting the no. of correct reponses recorded from the users for the tasks given.

- **Considering the user goal to hunt for the information in bare minimum time, the target of collecting the required information in under a minute per task / question was overshoots by about 40 seconds in User 1(Q1 & Q2) scenario** *Fig. 29.*

- **User 2(Q3) took enormous amount of time (217 seconds)** *Fig. 29.*

- **The standard deviation for Question 3 is quite high, due to the User 2's response** *Fig. 27.*

- **The average time taken stays under 1 minute target for all users per question** *Fig. 27.*
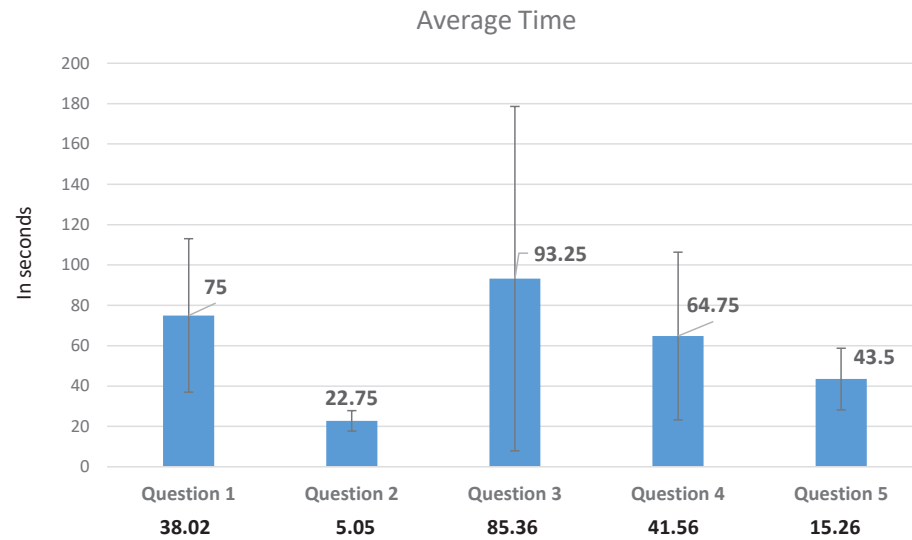
Fig. 27   Average time for cumulative effort of all users per question.
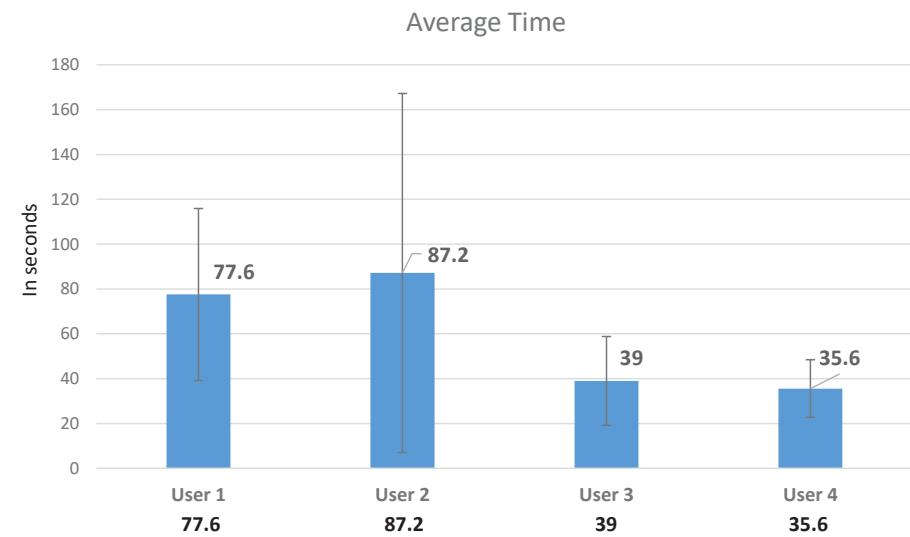
Fig. 28   Average time taken per user. Entire task.

Participant	Time taken (in seconds)				
	Q1	Q2	Q3	Q4	Q5
1	108	27	68	123	62
2	107	20	217	62	30
3	35	17	67	26	50
4	50	27	21	48	32

Fig. 29   Time break-up for each user and each question

Participant	Right / Wrong				
	Q1	Q2	Q3	Q4	Q5
1	Right	Right	Right	Right	Right
2	Right	Right	Right	Right	Right
3	Right	Right	Wrong	Right	Right
4	Right	Right	Right	Right	Right

Fig. 30   Correct / Incorrect reponses

6.2. Tasks & Heat Maps
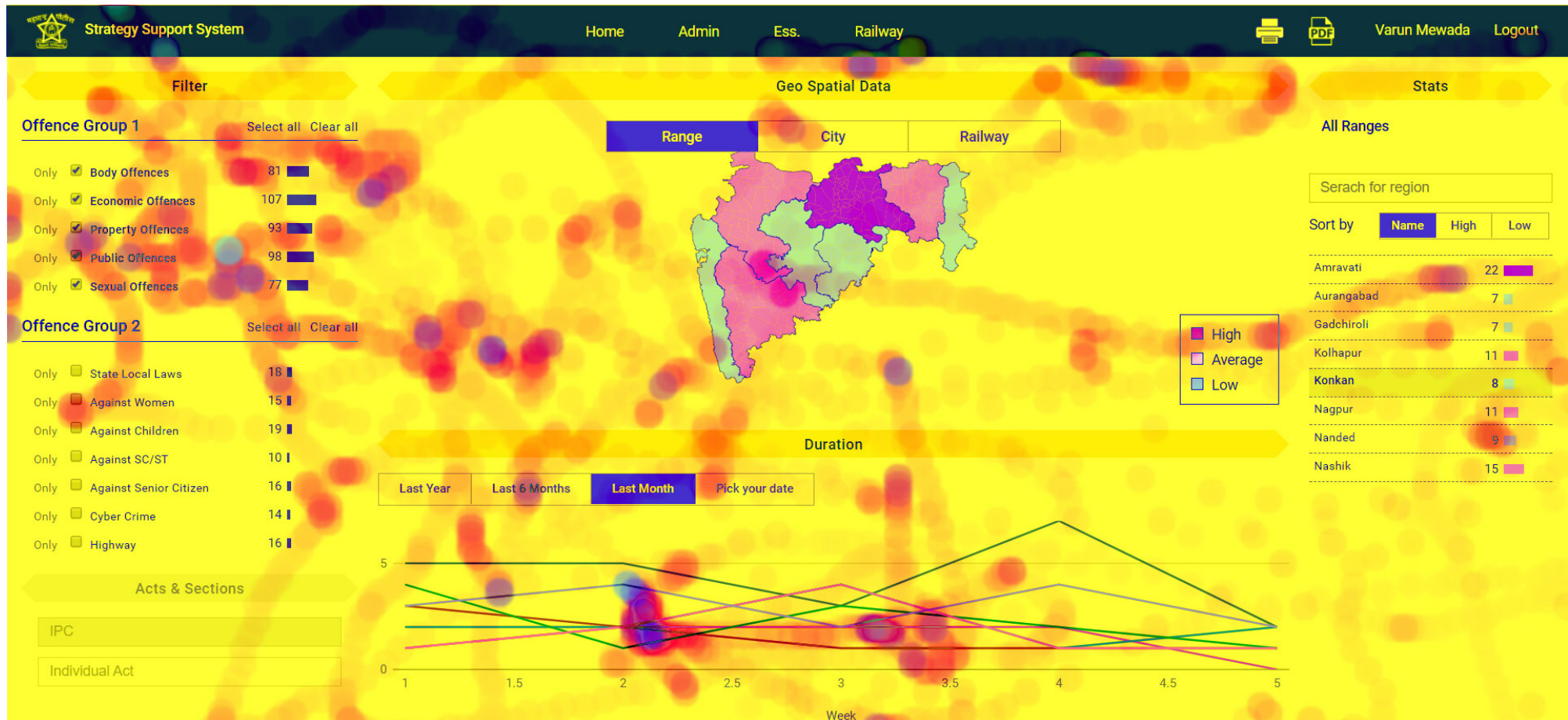
Fig. 31   Heatmap for Question 1. All users

1. During the last 6 months which range has the highest and lowest no. of F.I.R.'s registered respectively?

- Konkan & Nagpur
- Kolhapur and Konkan
- **Amravati & Gadhchiroli**
- Nashik & Nanded

For this the users had to apply the duration filter and then sort the data of ranges on the extreme right column to either ascending or descending order to get the answer.

- **As observed in the heat map all users has spent enough time exploring the left column of Offences group.**

- **They eventually looked at the graph but very less time was spend on the tabs for filtering duration.**

- **They did not sort the extreme right list of all ranges. Instead they manually went out to read the data sets.**
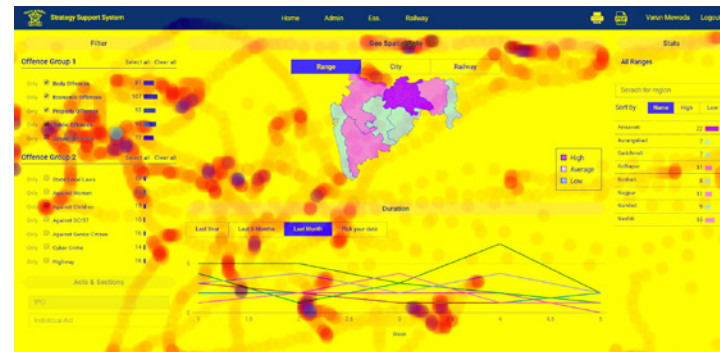
Fig. 32   User 1 - Q1 Heat map

Fig. 33   User 2 - Q1 Heat map

Fig. 34   User 3 - Q1 Heat map
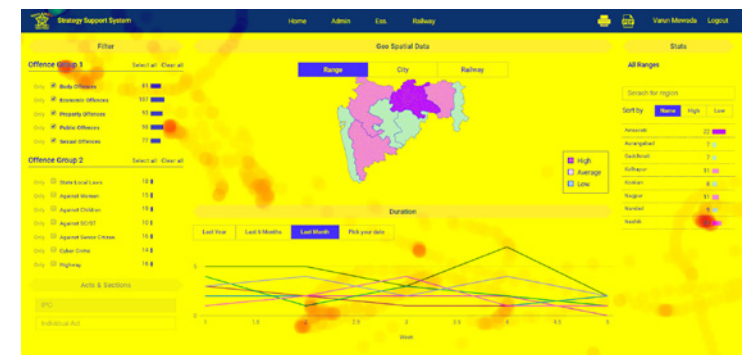
Fig. 35   User 4 - Q1 Heat map
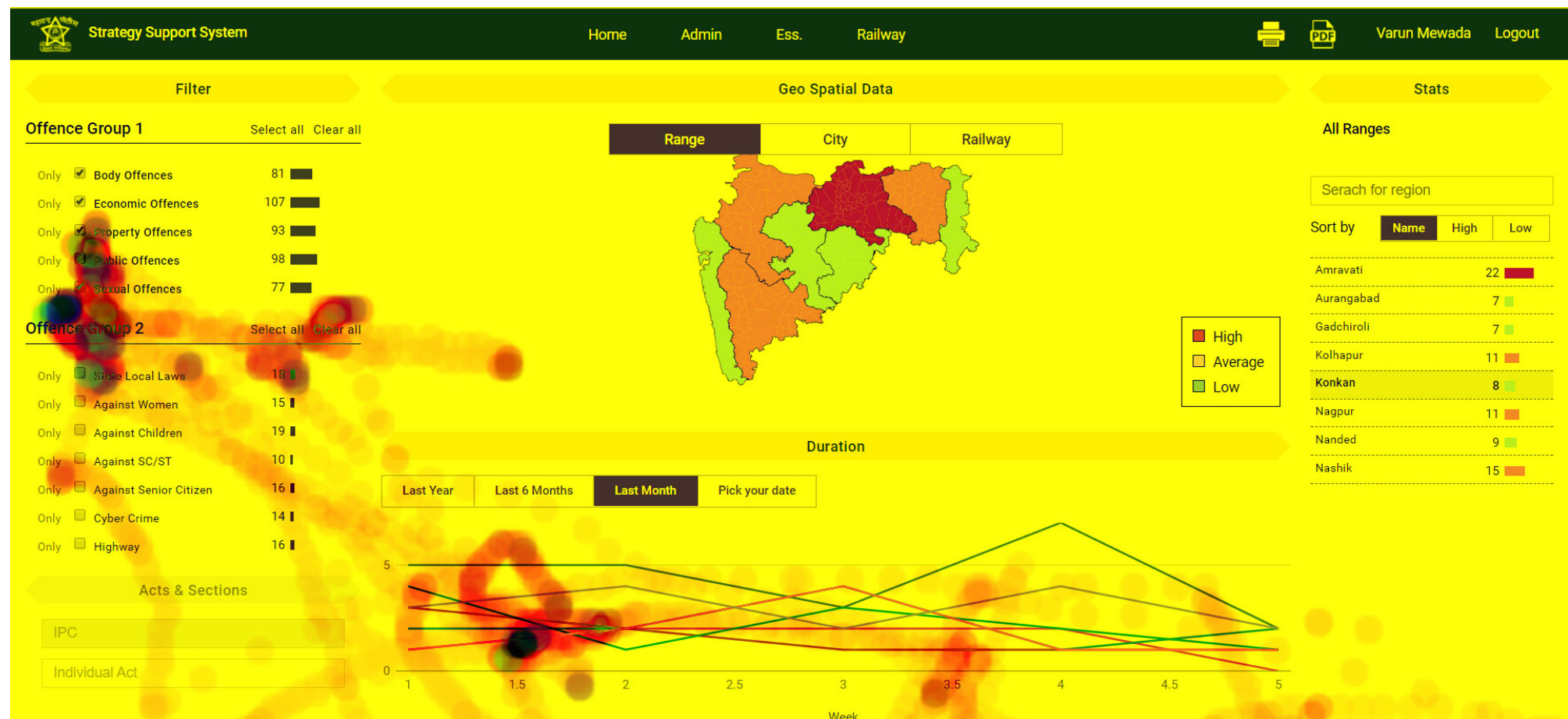
Fig. 36   Heatmap for Question 2. All users

2. In the last year how many total property offences sections have been registered?

- 1125
- **1084**
- 985
- 1905

Here the users had to just apply the duration filter and look at the count on the extreme left Offences group.

- **All users got it the answer right, from at the Offences count.**

- **Most of them looked at the graph and spent a good amount of time.**

- **Very less time was spent at the duration tabs.**

Fig. 37   User 1 - Q2 Heat map
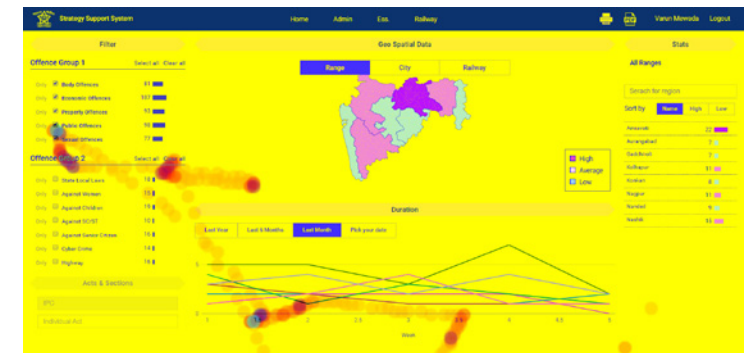
*Fig. 38   User 2 - Q2 Heat map*
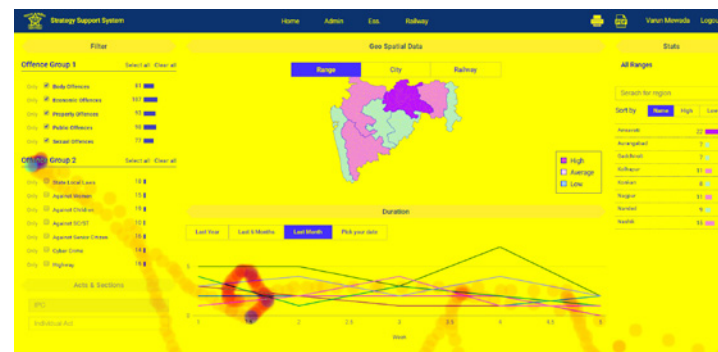
Fig. 39   User 3 - Q2 Heat map
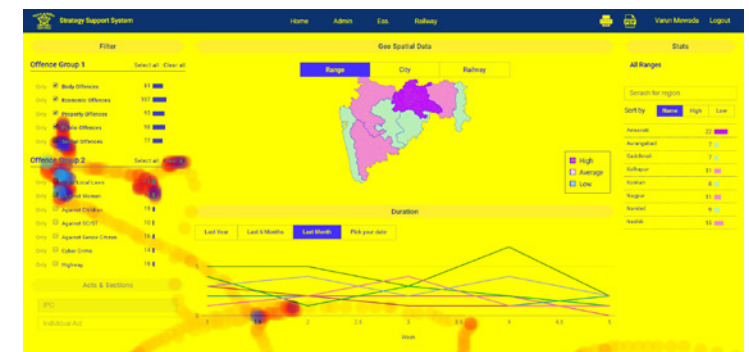
Fig. 40   User 4 - Q2 Heat map
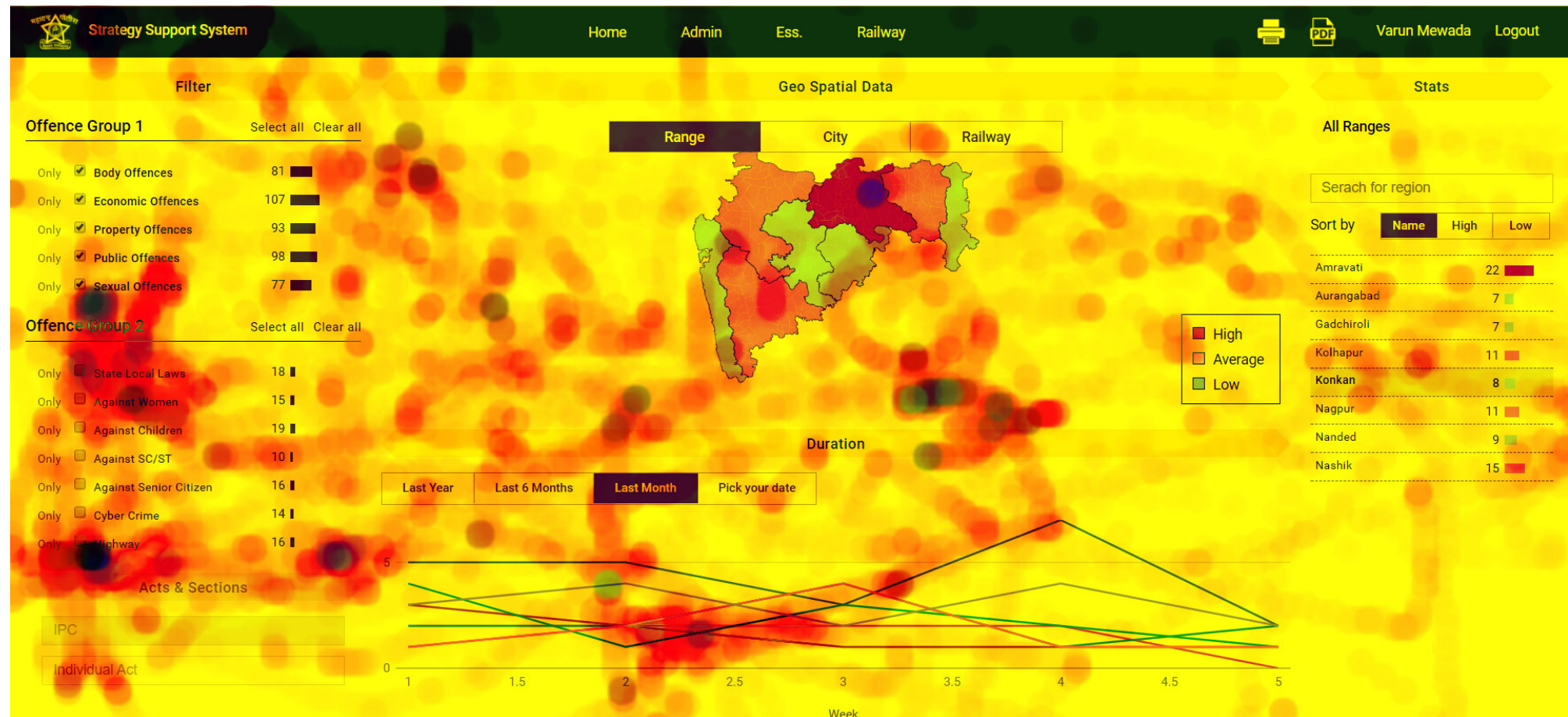
Fig. 41   *Heatmap for Question 3. All users*

3. What is the count of F.I.R.'s registered for Koyna nagar in Satara district of Kolhapur range against children registered in the last 6 months?

- 5
- 3
- 1
- **0**

The users had to look into the ranges column on the extreme right to locate the particular zone, then applying the 6 months duration filter.

- **User 3 as indicated in** *Fig. 44,* **failed to answer correctly.**

- **User 2 took a lot of time and went to search for a particular act from the search bar below on extreme left.**

- **User 4 was all over the place. Even after using it for a while the user did not know where to hunt for the information.**
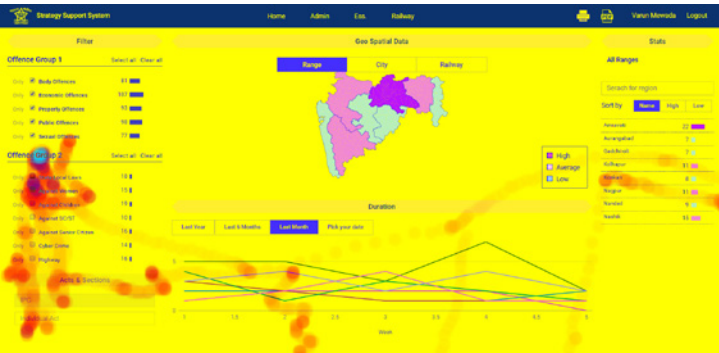
Fig. 42   User 1 - Q3 Heat map
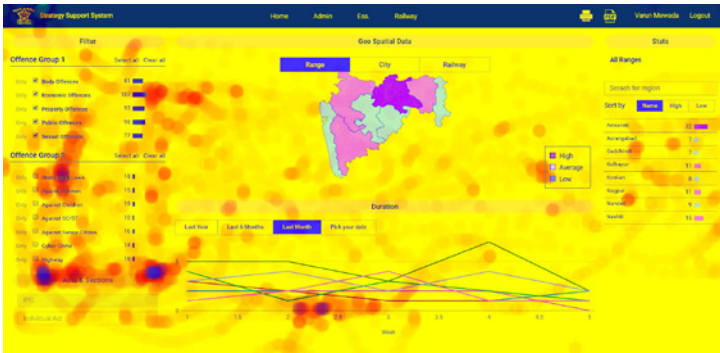
Fig. 43   User 2 - Q3 Heat map

Fig. 44   User 3 - Q3 Heat map
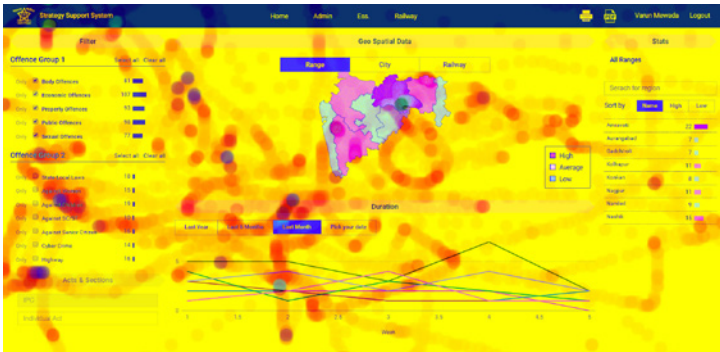
Fig. 45   User 4 - Q3 Heat map
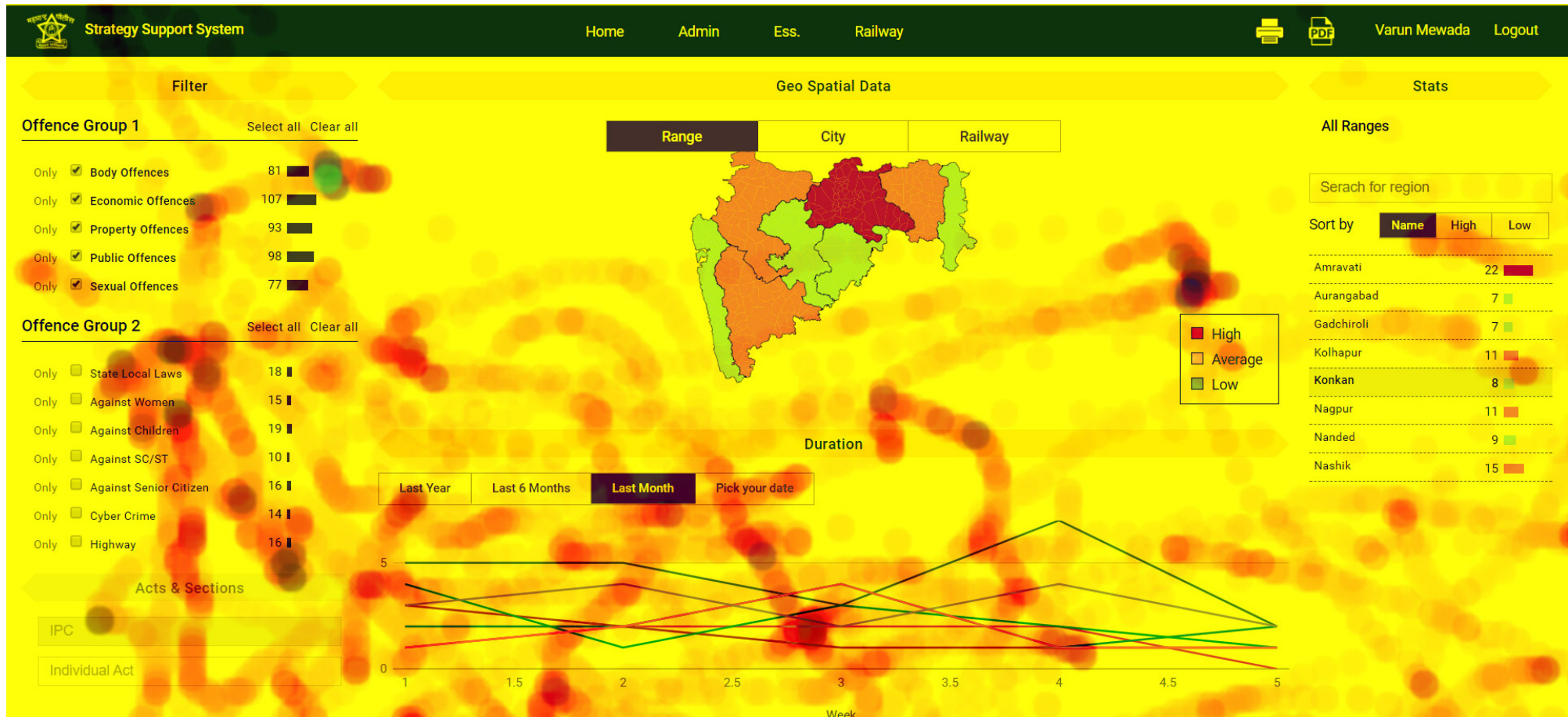
Fig. 46   Heatmap for Question 4. All users

4. How many F.I.R.'s of section 56 have been registered in for Gondia district in last month?

- $\frac{1}{20}$
- 20
- 0
- 3

The question was framed in a manner to allow the users to think about where the district falls, then they had to particularly look for the section 56 from the bottom left panel. This feature was provided for the users to look for a specific section.

- **Users 2 & 4 clicked on the legend assuming some interaction.**

- **User 1 seemed confused where to filter information for a specific act.**

- **The search bar for a particular section seemed out of place. Usually look to search information on the top bar. The search being a part of offences group was placed near to the offences group, but it clashed with the mental model of users to look for something on the top.**

Fig. 47   User 1 - Q4 Heat map

Fig. 48   User 2 - Q4 Heat map
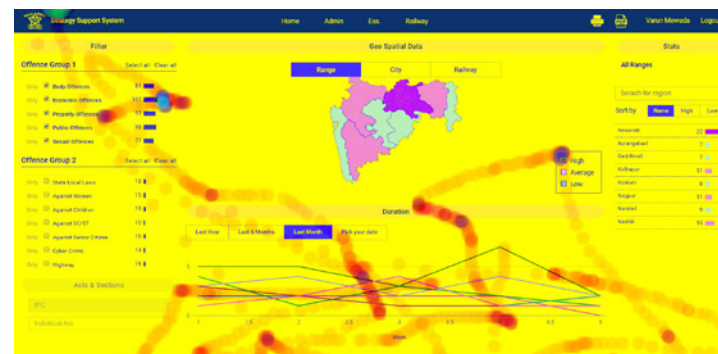
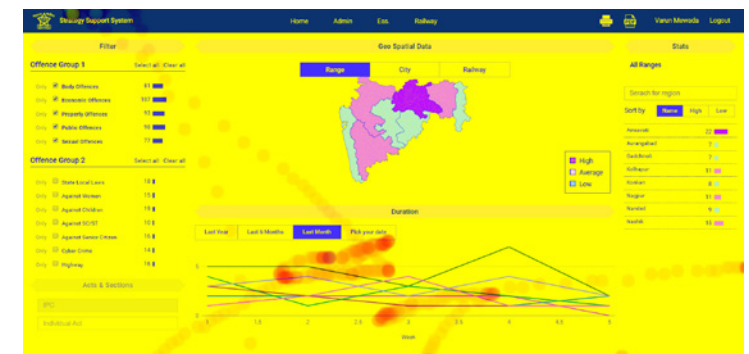*Fig. 49   User 3 - Q4 Heat map*

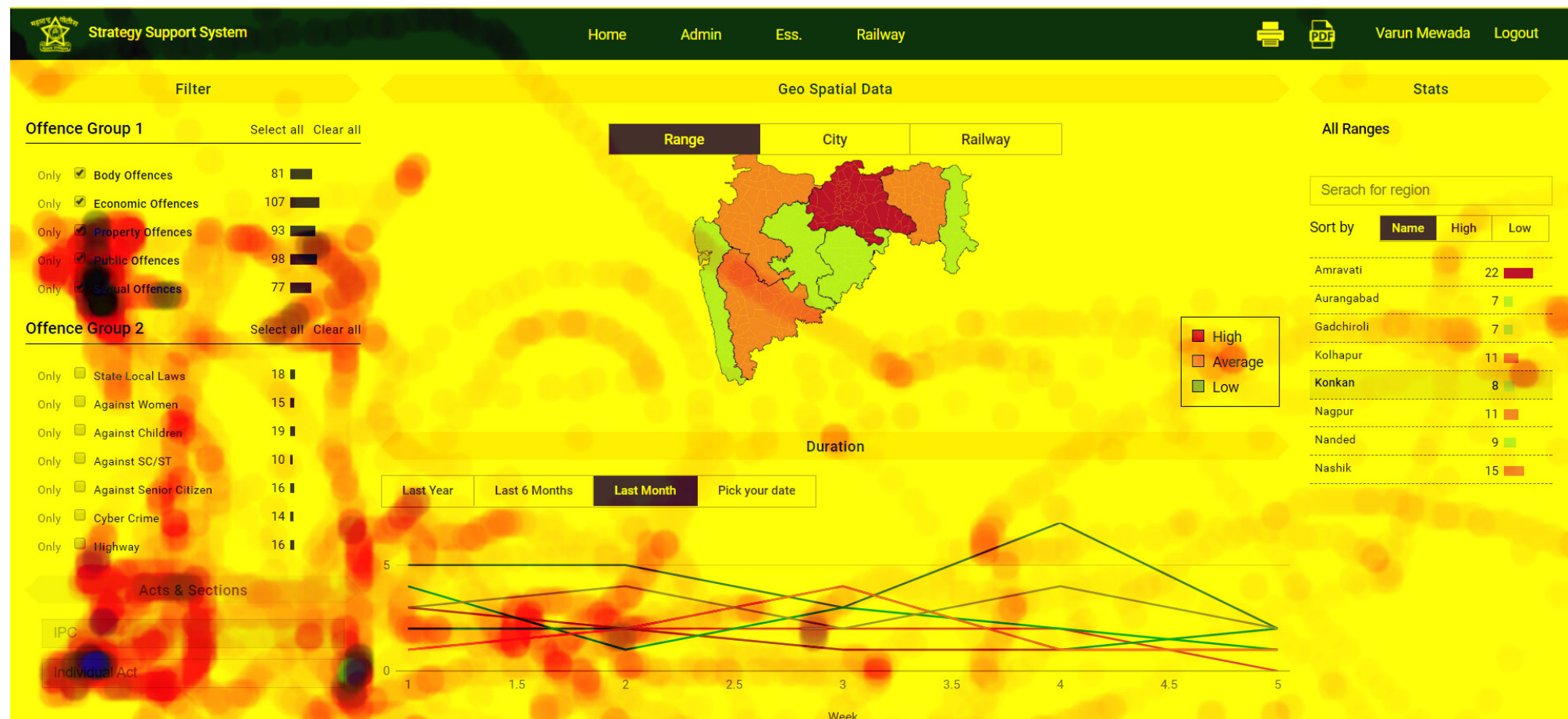*Fig. 50   User 4 - Q4 Heat map*

Fig. 51   Heatmap for Question 5. All users

5. Considering Economic offences and Property offences how many sections have been registered in Cyber crime in the last year?

- 250
- 3220
- **149**
- 107

All users hit the right zones for this question.

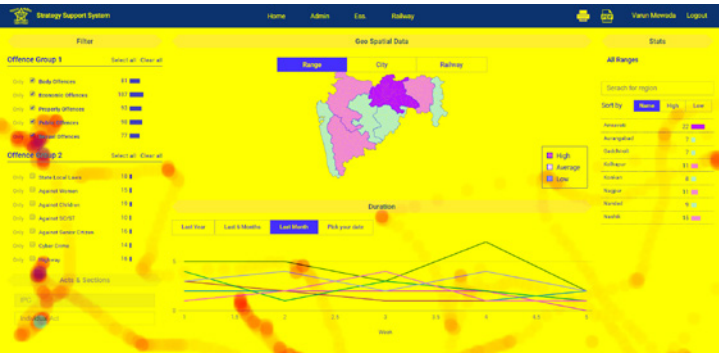- **User 4 seemed a little confused though. Spending more time, evident in the heat map.**
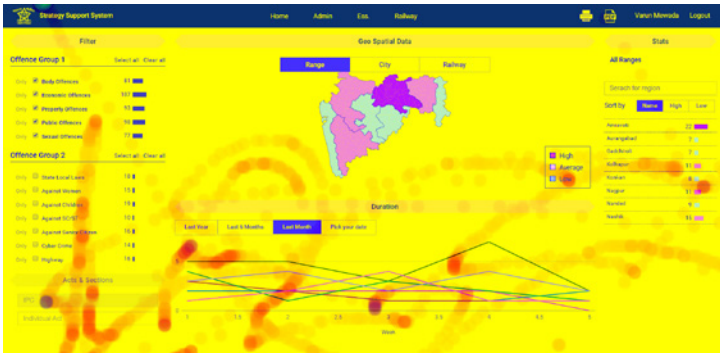

Fig. 52   User 1 - Q5 Heat map

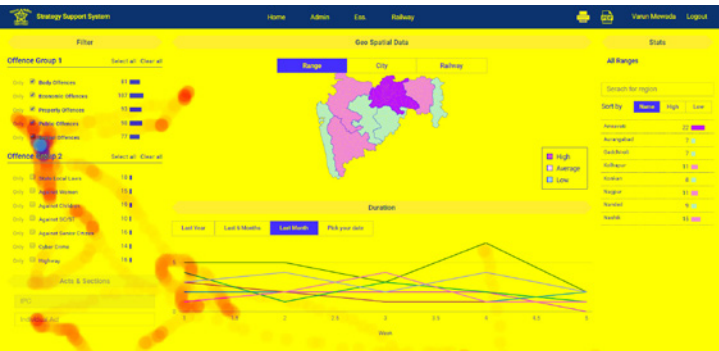*Fig. 53   User 2 - Q5 Heat map*

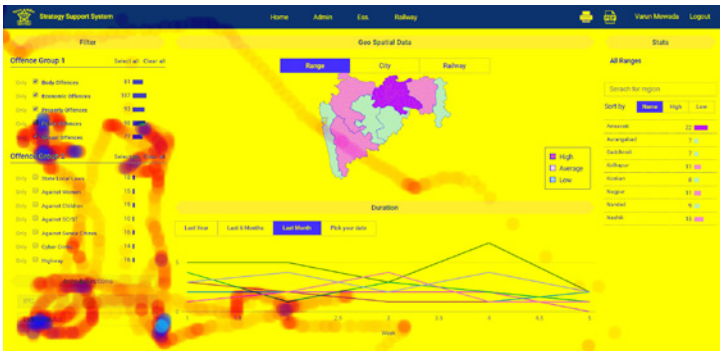*Fig. 54   User 3 - Q5 Heat map*

Fig. 55   User 4 - Q5 Heat map

6.3. Likert Scale

1. Is the overall text readable enough?

2. Are the colours on the map good enough to differentiate between high medium and low?

3. Does the stats list on the right hand side of the design communicate clearly about the no. F.I.R.'s registered in the range/ district / zone?

4. Does the filters list on the left hand side of the design communicate clearly about the no. sections registered in the particular offences group?

The likert scale stays on the positive side. The responses collected show favourability amongst the users.
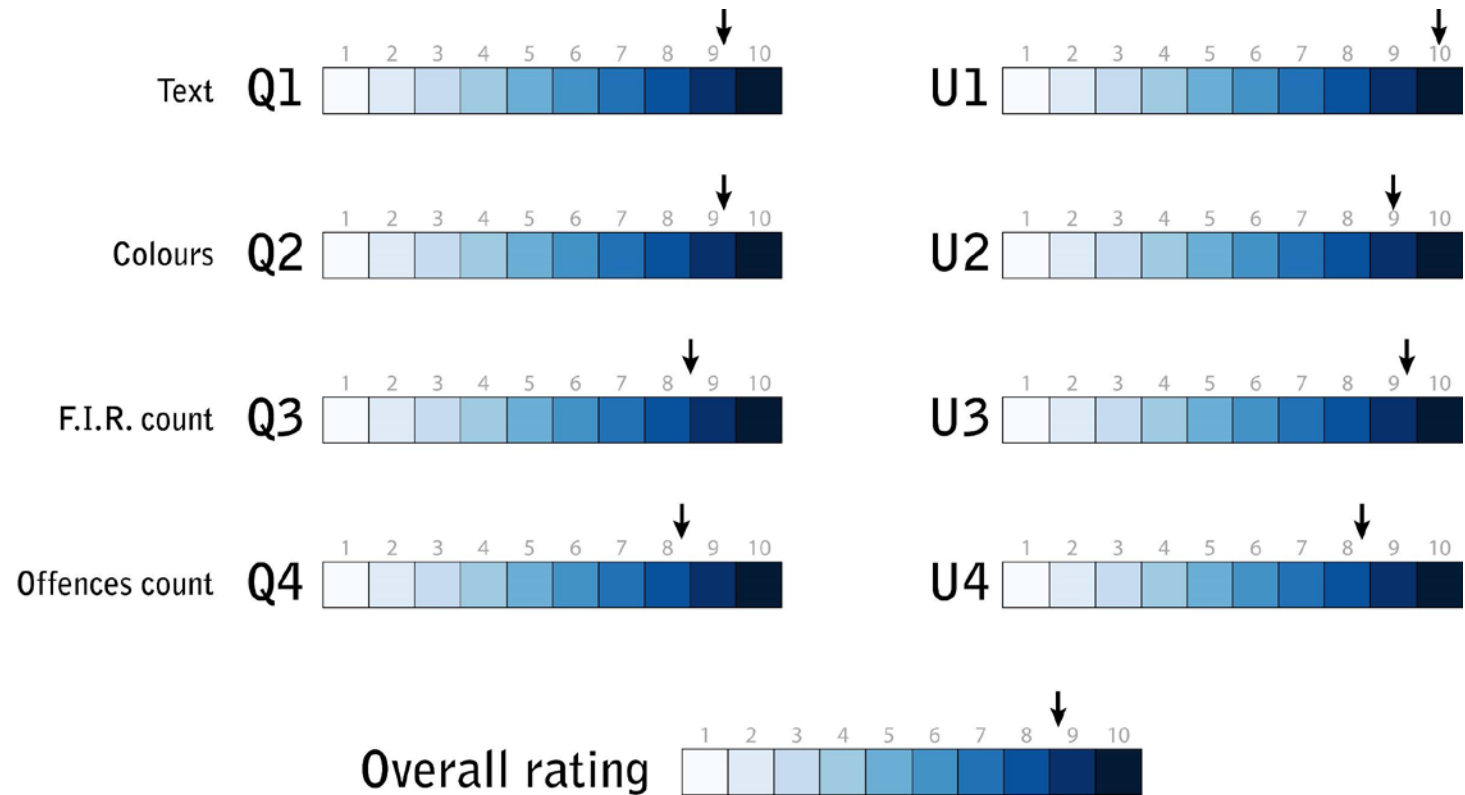
6.4. General Feedback

1. User friendly, need proper headings.

2. Notification bar or Pop window on RHS bar for FIR Count.

3. Date filter is too low ,it should be at high on left hand side.
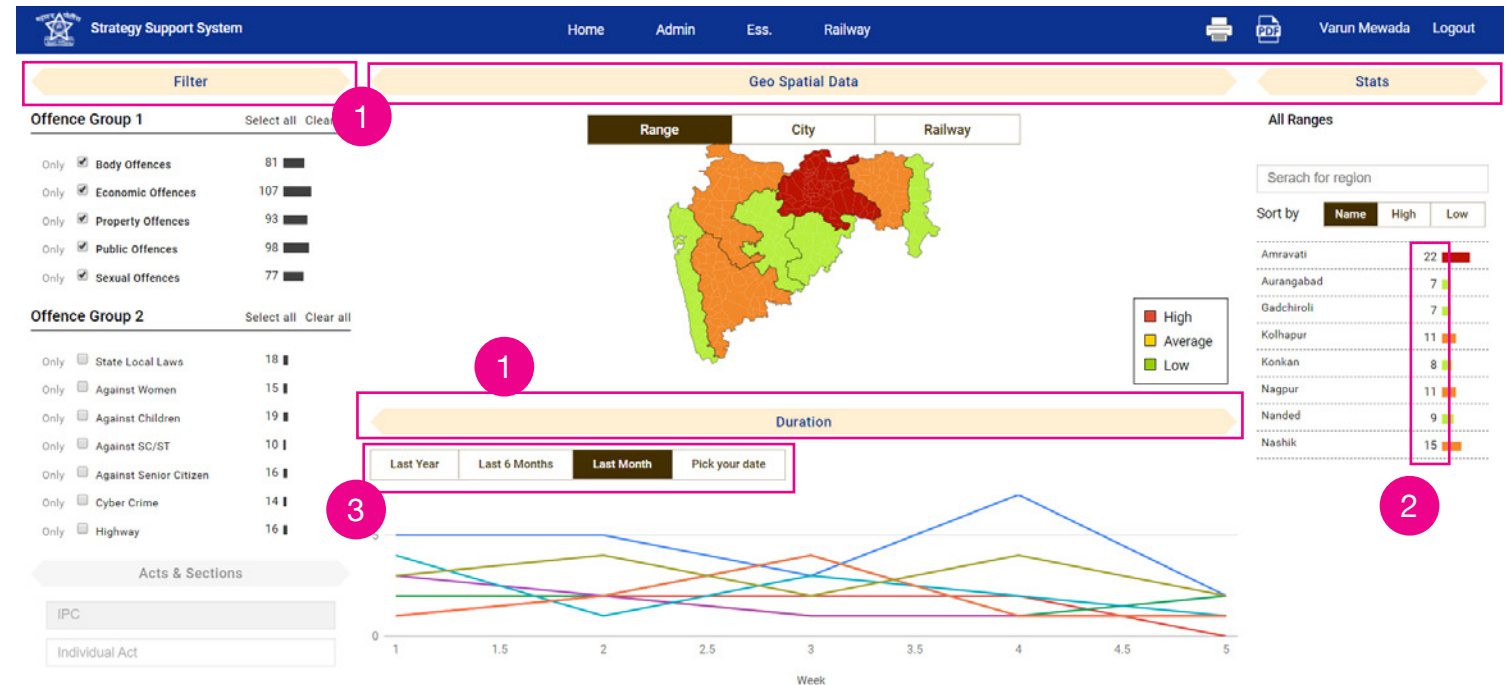
7. References

- **Abela, Dr. Andrew. n.d.** Extreme Presentation. Accessed 07 2017. *https://extremepresentation.com/about/*.

- **Crimereports.com. (2017, Aug).** Retrieved from Crime Reports: *https://goo.gl/H6ZiXw*

- **Met Police U.K.** Accessed 07 2017. *https://www.met.police.uk/stats-and-data/*.

- **National Crime Records Bureau**. Accessed 07 2017. *http://ncrb.gov.in/BureauDivisions/cctnsnew/index.html*.

- **Rosling, O. (2017, August)**. gapminder.org. Retrieved from Gapminder: *https://goo.gl/VMEiSI*

- **Soegaard, Mads. 2017**. Visual Hierarchy: Organizing content to follow natural eye movement patterns. 08. *https://goo.gl/iUW5nY*.

- **Zhang, Chao, Manish Jain, Ripple Goyal, Arunesh Sinha, and Milind Tambe. 2015.** "Learning, Predicting and Planning against Crime: Demonstration Based on Real Urban Crime Data." AAMAS.