

## **Clima-A Climate Data Tool**

Project report submitted in fulfillment of the  
requirement for the degree of  
Bachelor of Technology

In

Computer Science and Engineering

By

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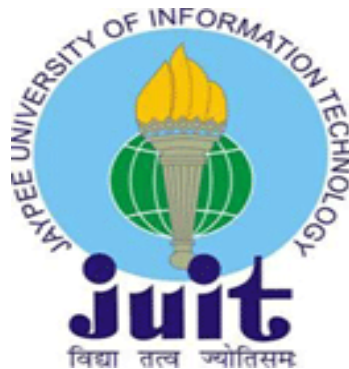
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Under the supervision of

Ms. Sunandini (Senior Associate, ETA, Infosys Ltd.)

To



Department of Computer Science and Engineering and Information Technology

**Jaypee University of Information Technology, Wahnaghat,**

**Solan-173234, Himachal Pradesh**

## **CERTIFICATE**

### **Candidate's Declaration**

This is to specify that the work which is being presented as the report entitled “Clima-A Climate Data Tool” in partial fulfillment for the requirements for the award of the degree of **Bachelor of Technology** in Computer Science and Engineering/Information Technology submitted in the department of **Computer Science Engineering and Information Technology**, Jaypee University Of Information Technology, Wagnaghat is an authentic record of our own work carried out in the period of 19<sup>th</sup> April,2017 to 31<sup>st</sup> May,2017 under the supervision of Ms. Sunandini (Senior Associate in the department of Education, Training and Assessment at Mysuru Development Centre, Infosys Ltd, Karnataka).

The matter enclosed in the report has not been submitted for the award of any other degree or diploma.

**Kishan Keswani(131222)**

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This is to certify that the above statement made by the candidate is true to the best of my knowledge.

**Ms. Sunandini**

**Senior Associate,**

**ETA, Infosys Ltd.**

**Dated:** 31<sup>st</sup> May, 2017.

## **ACKNOWLEDGEMENT**

We owe our profound gratitude to our project supervisor **Ms. Sunandini**, who took keen interest in our project and guided us all through the development phase under the project **Clima-A Climate Data Tool**, till the completion of our project by providing all the necessary information for the project. This thoroughly helped us in carrying out fruitful research and sound technologies. We are really thankful to her for all the support rendered.

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## **ABSTRACT**

Clima- A climate data tool project is designed to retrieve data about the weather of a particular region and state and represent it in the form of various charts, made of data stored in the past(historical data). Admin can add or delete data in the database. Our main goal is to provide an easy , understandable , and interactive user interface they can check whatever they want regarding the same online.

It is a service which extracts and interprets data-sets which contains information about the weather of a particular region exposing some of the information in a nicer format through a simple web API .Information about the weather can include local climatological data, the normal monthly/seasonal, Snowfall data ,precipitation levels, the marine data etc. It properly utilizes graphical images .

Technologies implemented in the project are Java programming, Hibernate. For user interface html-5 ,CSS3,JavaScript ,Bootstrap,Angular-Chart.JS and Angular JS has been used.Creation of RESTFUL Web Services using JAX-RS 2.0 have been implemented.

# CHAPTER 1

## INTRODUCTION

Clima-A Climate Data Tool is a web based application, whose requirement is to fetch the data related to particular state and region in different form of representation. The project is divided into 3 tiers-Persistence tier, Business tier and Presentation tier. Presentation tier deals with the view of the user. Business tier deals with the business logics of the project and deals with some validations, if required. Persistence tier deals with interaction of user data with the data bases. It includes various operations like inserting data, deleting data and updating data.

The project deals with 2 types of users, i.e. normal user(viewer) and admin. A viewer can select state and region for which he wants to retrieve the data. Also, a viewer can select the different parameters like precipitation, average temperature, minimum temperature and maximum temperature. The data is displayed in tabular form and viewer can select different type of charts to represent that data. The different types of charts available are- Line Chart, Bar Chart and Pie Chart. Viewer can also download the tabular data in .pdf format and chart can be downloaded as image in .png format.

There can be any number of admins. An admin starts the process of adding or deleting data by first logging into the website. In this, username and password are validated. If valid, an admin can either add data in mass by uploading a file or in the form of single entry through forms. An admin can delete the data based on year, state or region.

## **1.1) PROBLEM STATEMENT**

Clima-A Climate Data Tool is a website that provides a user with all the climatic data of a particular location. A user can view the data of different locations which he can use for further analysis. A user can view the precipitation details in inches and mm format and the minimum temperature, maximum temperature and the average temperature in Celsius and Fahrenheit format.

These details fetched by the user can be used for analysis of rainfall pattern and temperature variations of different regions. This data is also available in chart format which helps the user to easily visualize the above patterns. With the help of this data the viewer can analyze if global warming is taking place, or if there are drought conditions in that particular region. Through this various amendments can be made.

An admin can add or delete the data from the database. He can either add a single entry as a form input or he can add data in bulk in the form of an excel sheet.

## 1.2) OBJECTIVE

Any user using this website demands user friendly and an easy to use environment. Also, the data provided should be correct and consistent. To maintain the accuracy of data only an admin with sufficient privileges can add or delete the data. Thus, the data entered by the admin is secured and reliable providing a user with accurate data. The climatic data retrieved for different locations are displayed in a tabular format as well as displayed in the form of a chart which makes our website user friendly.

### 1.3) METHODOLOGY

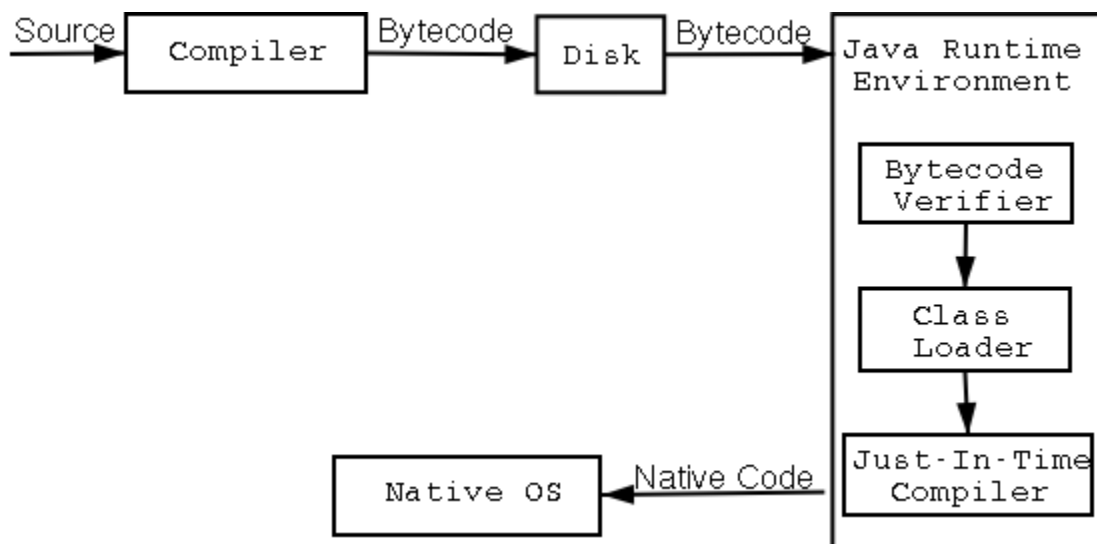
Clima-A Climate Data Tool Project is divided into three tiers. Each tier has some functional responsibility which adds to the feature of the project. Also, project division into tiers make our project modularisable and easy for maintenance. The different tiers are-

1. Presentation Tier – This tier consist of the view which is shown to user who is using it. The tier is made in such a way that a person who is using it find its user friendly and easy to use. The technologies used in this tier are different front end languages like HTML5,CSS3 and Bootstrap. Also, some client side validations are done which are coded in Javascript and use of some controllers in angular-JS which promotes our data to feed to databases through various methods like GET,POST and delete(if required).
2. Business Tier – This tier deals with different business logics which are required to be done for the fulfillment of project. Also the project includes various service classes to pass the data to the other tier which interacts with the databases. It also include various validation classes and different methods like sorting etc. ,if required.
3. Persistence tier – The main job of this this tier is to interact with databases. The tier is responsible for inserting the data, updation of data, deletion of data or fetching of data from the databases. It uses entity classes to interact with databases. Here various technologies like Hibernate, HQL and criteria API are used.

## 1.4) LITERATURE SURVEY

Our project depends on different languages-

1. **Java:** Java is a simple, object-oriented programming language developed to serve various business domains like banking, insurance, education, entertainment etc. Features of Java includes-Object Oriented, Robust, simple, Multi-threaded, Secure and platform independent.



**Figure :1**

If a program written on a particular platform can run on other platforms without any recompilation, it is known as platform independence. Since Java is platform independent, it is not a problem. A program written using Java on Windows will execute without any recompilation on any other platform.

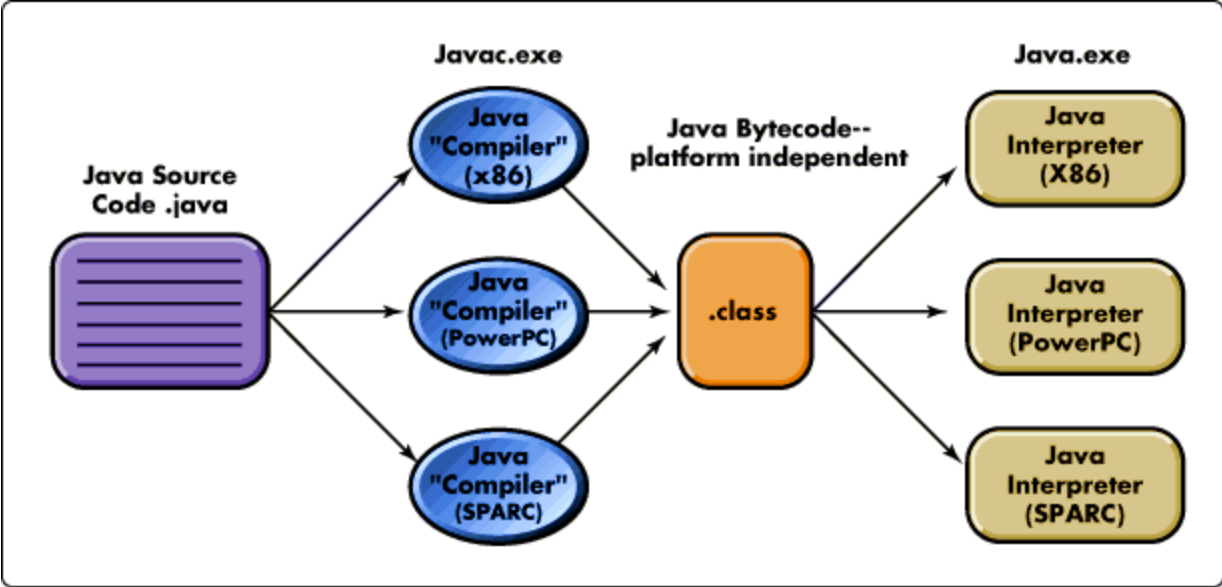


Figure:2

Business tier is completely designed in this language and uses different features of Java making our project platform independent. Various API's ,persistence tier uses java partially.

- 2. **Hibernate:**With the help of hibernate, a Java application can store, retrieve or process the data in or from a file system and database. Hibernate is an open source ORM implementation for Java developers which follows JPA standards. The architecture followed in hibernate can be well explained by a diagram-

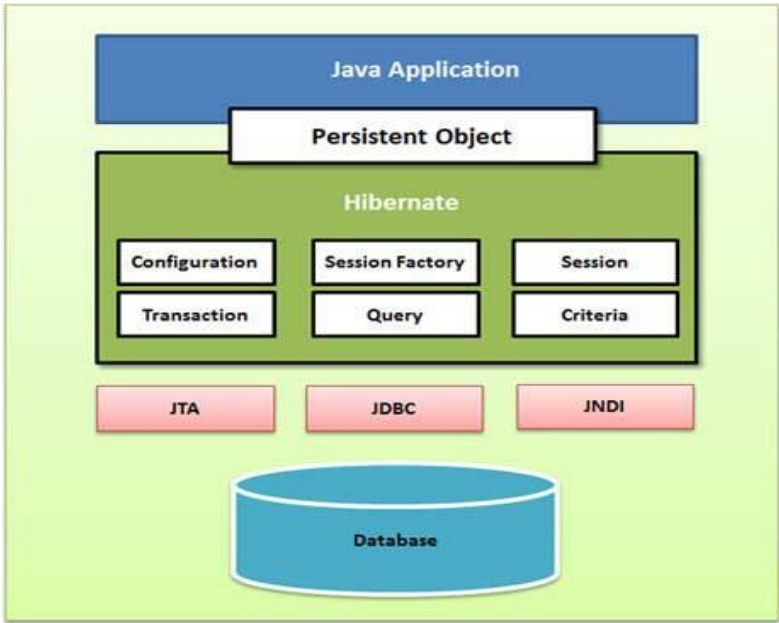


Figure:3

### **HQL(Subpart of Hibernate):**

To retrieve data using non-primary key value, use of either get() or load() methods is not possible, so Hibernate Query language (HQL) is used. HQL is same as SQL in its appearance, but instead of operating on tables and columns, HQL works with entity classes and its properties. Using HQL, any DML operations can be performed that can be done with SQL.

### **Criteria API(Subpart of Hibernate):**

It is another way of interacting with databases which is written completely in java and easy to find syntax error because errors are detected at compile time unlike HQL where errors are detected at run time. Also it is used for dynamic queries.

HQL	Criteria API
Can be used for all CRUD operation	Can be used for retrieval operation only
Defined using query string	Defined by Java objects representing query elements
Errors are detected at runtime	Errors are detected at compile time
Preferred for static queries	Preferred for dynamic queries

**Table :1**

### **Advantages of Hibernate-**

1. Hibernate supports Inheritance, Associations, Collections.
2. Hibernate supports relationships like One-To-Many,One-To-One, Many-To-Many-to-Many, Many-To-One.
3. Hibernate has capability to generate primary keys automatically while we are storing the records into database
4. Hibernate has its own query language, i.e hibernate query language which is database independent



5. Hibernate supports annotations, apart from XML
6. Hibernate supports caching mechanism by this, the number of round trips between an application and the database will be reduced, by using this caching technique an application performance will be increased automatically.

### **3.HTML:**

HTML-Hypertext markup language is a front end language used for view part to the user. The data is stored in a file which has .html extension. The interaction of front end with backend is done through various controllers. HTML does not deal with any kind of validation or logic. There exists various versions of HTML like HTML 3.2, HTML 4.0, HTML 5 and HTML 4.01.

Different features with the different versions are associated making HTML user friendly and automation of tasks. It includes various features like table, lists(unordered and ordered), handling images, videos etc.

### **4.CSS:**

CSS(Cascading Style Sheets)uses various selectors, properties and values required to style a web page. It separates the page content from the presentation allowing for greater flexibility and control over styling. CSS uses various colors and fonts to make web pages look more attractive. CSS can be added in three ways to HTML-

Inline CSS- CSS can be added to any of the HTML tags using the style attribute. The styling here is applied only to the data present inside that particular tag.

Embedded CSS- In embedded CSS ,CSS is separated from the HTML content. The styling data is present in the style element which is written in the head section of the page. The styling here is applied only to the data present on the same page.

External CSS-In external CSS, the styling data is written in a separate file with a .css extension. The major advantage of using external CSS is that the styling can be applied to any number of pages.

### **5.Bootstrap:**

Bootstrap contains various classes that help in designing responsive webpages. It has many classes required for adding styles to text and UI components. The major advantage of Bootstrap over CSS is that in CSS the degree of compatibility varies with various browsers. Bootstrap is

a complete CSS framework offering Grid system and configurations, Typography classes and UI components like forms and tables. It is a widely used framework in the development of responsive website.

### **5.Angular -JS:**

Angular-JS is a Javascript framework which is made up of several javascript files which helps in organizing and structuring the code. It reduces the number of lines of code to be written making it easier and faster to create web applications.



## **CHAPTER 2**

### **SYSTEM DEVELOPMENT**

#### **2.1) Functional Requirements**

1. There will be a login portal for admin so that he/she can login to their respective account.
2. There will be a logout mechanism so that admin can logout.
3. Admin can add climate details for a particular region, month and year.
4. Admin can add climate details in bulk in the form of a file for different regions and states.
5. Admin can delete entries from the database for a particular year.
6. Admin can delete entries from the database for a particular region.
7. Admin can delete entries from the database for a particular state.
8. User can select a state and region whose climatic data he wants to view.
9. User can select the parameter like precipitation, minimum temperature, maximum temperature and average temperature.
10. In case of temperature user is able to select the unit in which he/she wants the data in- Celsius or Fahrenheit.
11. In case of precipitation user is able to select the unit in which he/she wants the data in- millimeters or inches.
12. User is able to view climatic data in the form of a table.
13. User is able to view climatic data in the form of different charts.
14. User is able to select the type of chart he wants to view- line chart, bar graph and pie chart.

15. User can download the table in .pdf format.

16. User can download the chart in .png format.

## 2.2) Non Functional Requirements

**1) Authentication:**

Admin can login only if his username and password match with the credentials present in the database.

**2) Security and Privacy:**

The password of the admins are secured in the database using some encryption algorithm.

**3) Portability:**

This website is able to run on various web browsers like Internet Explorer, Google Chrome or Mozilla Firefox.

**4) Maintainability:**

This application is modular and uses techniques like Criteria API (Hibernate) making it easier to maintain.

**5) Robustness:**

This application handles all types of errors and exceptions gracefully by printing appropriate and easy to understand error messages.

**6) Usability:**

The user Interface of this application is user friendly.

## 2.3) SOFTWARE REQUIREMENTS

<b>ENVIRONMENT</b>	Eclipse, Oracle 11g
<b>Language and Web Technology</b>	HTML5, CSS3, Bootstrap, JavaScript, Angular-JS, JAVA, Hibernate

## 2.4) HARDWARE REQUIREMENTS

<b>OPERATING SYSTEM</b>	Windows 7 or above
<b>RAM</b>	4GB RAM
<b>HARD DISK</b>	80 GB Hard disk

## **CHAPTER 3**

### **PERFORMANCE ANALYSIS**

#### **3.1) TESTING ANALYSIS**

Testing is a stage which aims to serve the purpose of ensuring that system or working software produced is working efficiently and handling errors and exception correctly. Also it is done to ensure that user see the proper messages, if something unusual happen. It is one of the important phase of software development. Different types of testing are involved- Unit testing, Integration testing, Black box testing, white box testing and system testing. The end product produced should meet all user requirements(functional).

#### **1. FOR INDEX PAGE:**

1. List of States are displayed in dropdown which are fetched dynamically from database.
2. List of regions according to state selected by user is fetched dynamically and displayed in dropdown.
3. List of years for the start year dropdown is fetched dynamically corresponding to the state and region selected.
4. List of years for the end year dropdown is fetched dynamically corresponding to the state ,region and start year selected.
5. User is able to select the parameter one at a time (radio button) for which the data is to be displayed .
6. By default, the parameter selected is precipitation.
7. After selecting the four options and on clicking the find button data in table format and a chart is displayed.
8. By default, the data and the chart displayed should be for precipitation.
9. On selecting a different parameter ,the table and chart displayed changes.
10. If parameter is precipitation, then user is able to select the unit in which data is to be displayed (millimeters or inches).

11.If parameter is minimum temperature, maximum temperature or average temperature, then user is able to select the unit in which data is to be displayed (Celsius or Fahrenheit).

12. User is able to select the type of chart to be displayed i.e. line chart or bar chart.

13. For each chart appropriate legends are displayed in different colors.

14. On clicking on the Download Content button ,the table gets downloaded in .pdf format.

15.On clicking on the Download Image button ,the chart along with the legends gets downloaded in .png format.

16.On the navigation bar two links for Home and Admin should be present.

17.On clicking on the Home link the page gets redirected onto the index page.

18.On clicking on the admin link the page gets redirected to the admin login page.

## **2. FOR ADMIN LOGIN PAGE:**

1. There should be textboxes for the username and password.
2. On entering the username ,it should validate the username and if valid then it should display the login button.
3. If the username is invalid then a message “You are not an admin” is displayed.
4. On entering the password, it should validate the password and if valid it should navigate to addDelete page.
5. If the password is not valid then a message “Password is not matching” is displayed.

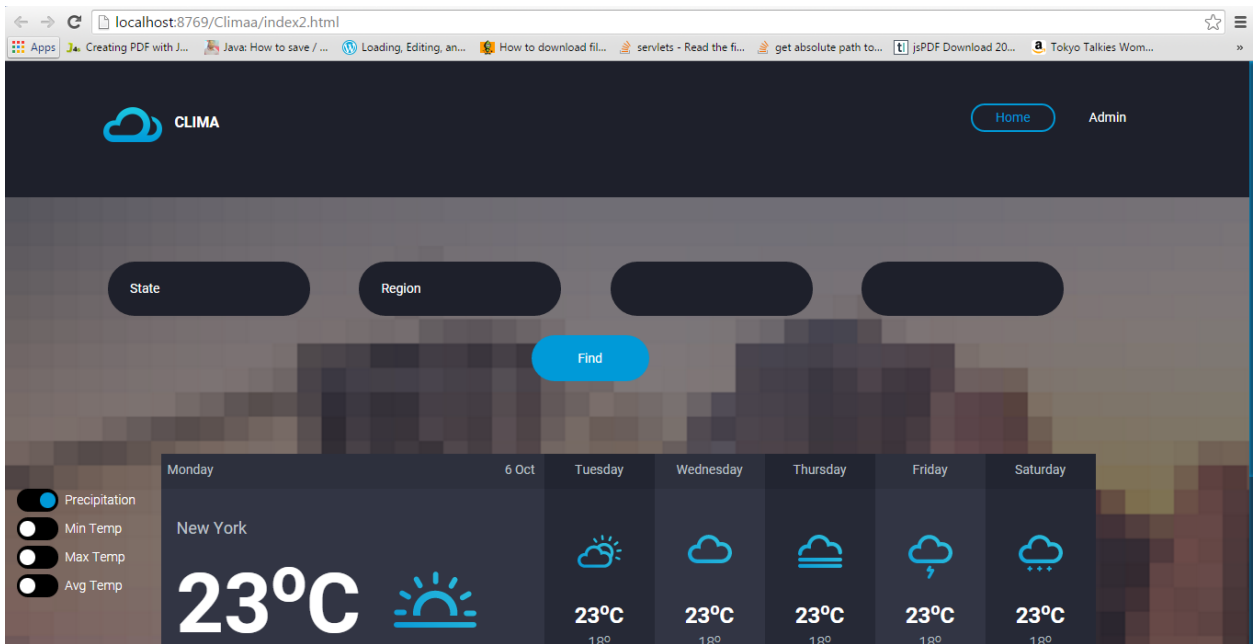
## **3. FOR ADD DELETE PAGE:**

- 1.On the navigation bar two links should be present Home and Logout.
- 2.On clicking on the Home link the page gets redirected to the index page.
- 3.On clicking on the logout link the page gets redirected to the index page and the session is cleared.



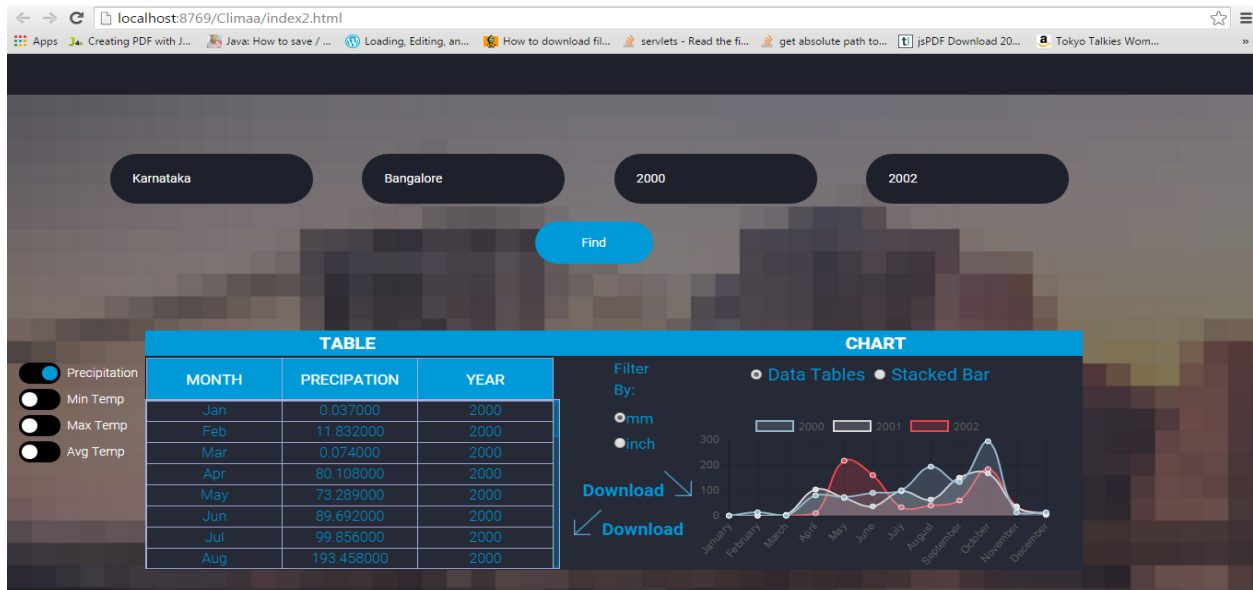
4. On the navigation bar the current admin name should be displayed.
5. Two buttons for Add Data and Delete Data should be displayed.
6. On clicking on the Delete Data button, three options are displayed –delete by region, year or state.
7. On selecting any one of the options a textbox along with the delete data button is displayed.
8. On successful deletion of data , a message “Data deleted successfully” with the number of rows deleted is displayed.
9. By default, a form for add data or a button for multiple entry should be displayed.
10. For single entry, after filling a form and on clicking the Add Details button, for successful addition a message “Details added successfully” is displayed.
11. If unsuccessful, then a message “Details already exist” is displayed.
12. For multiple entries, a button for Choose File and a button for Add Details are present.
13. Admin see the choose file button.
14. On Clicking the Add Details button, the data of file is saved in databases.
15. The data added has some constraints of format, if admin enters the file which is in wrong format, a message is displayed in which place there is error.
16. If the data is already in databases, a message “Data already exists” is displayed.

## Home Page



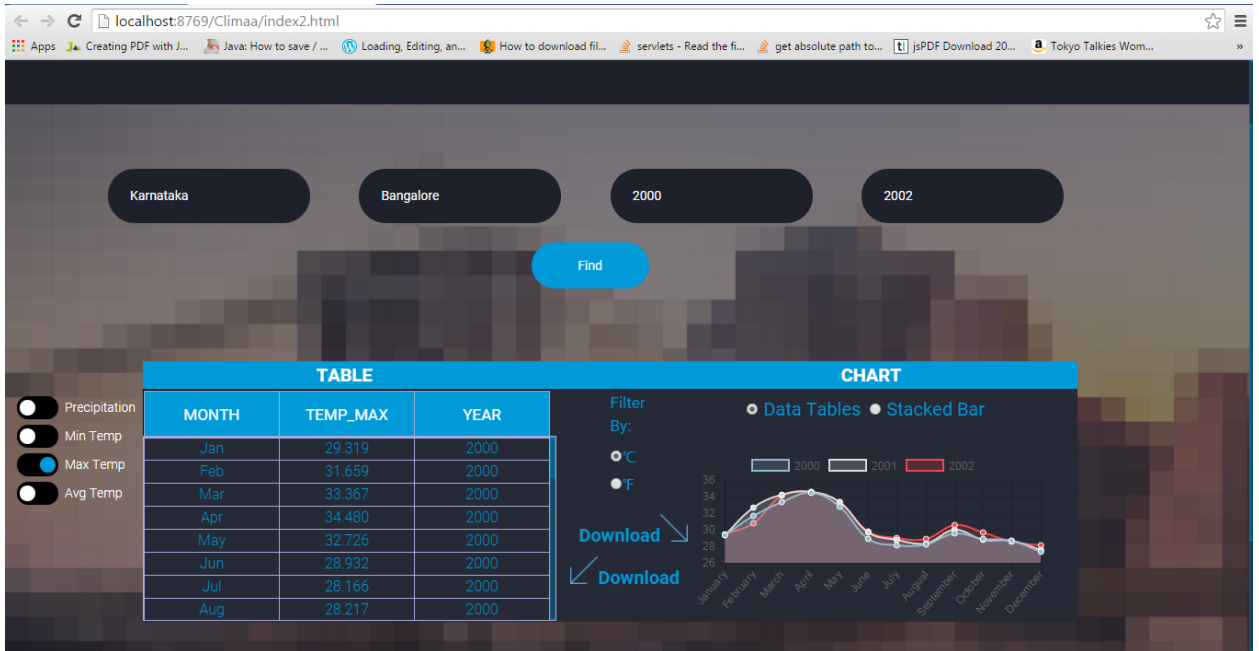
Screenshot: 1

## Home Page with Data and Chart



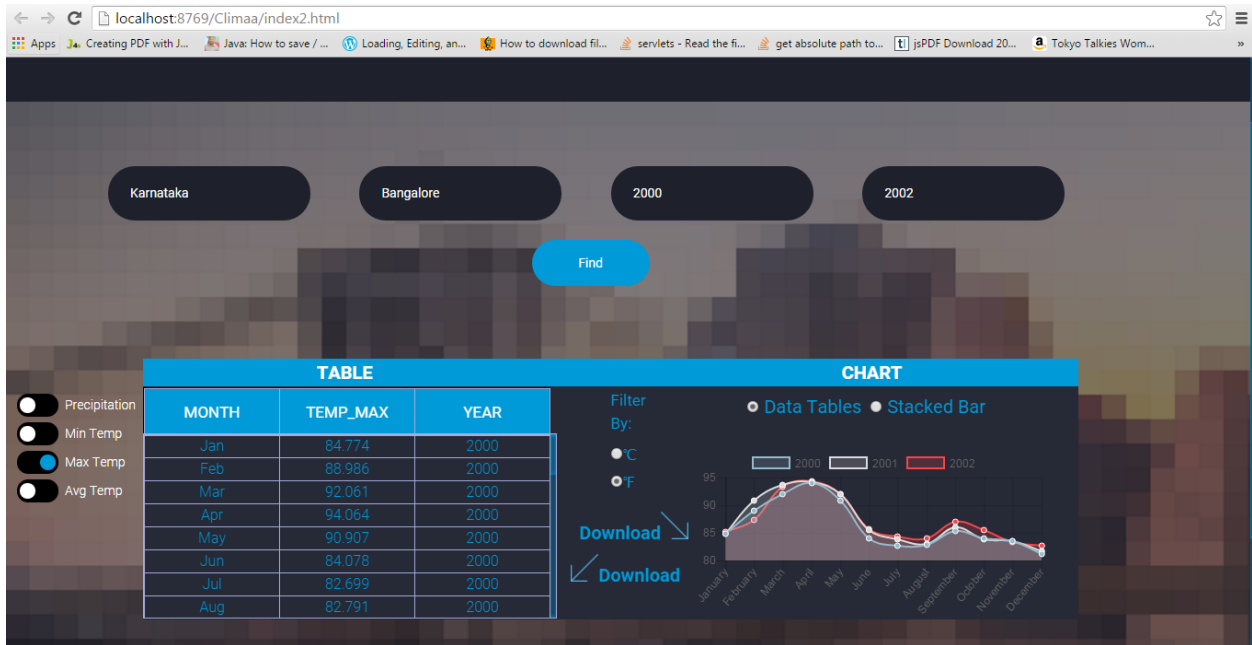
Screenshot: 2

## Home Page with Max\_Temp (in Celsius) selected



Screenshot: 3

### Home Page with Max\_Temp (in Fahrenheit) selected



Screenshot: 4

### Home Page with chart as Bar Chart

Browser: localhost:8769/Climaa/index2.html

Buttons: Karnataka, Bangalore, 2000, 2002, Find

Table:

MONTH	TEMP_MAX	YEAR
Jan	84.774	2000
Feb	88.986	2000
Mar	92.061	2000
Apr	94.064	2000
May	90.907	2000
Jun	84.078	2000
Jul	82.699	2000
Aug	82.791	2000

Chart: Filter By: C, F. Legend: 2000 (blue), 2001 (grey), 2002 (red). X-axis: January to December. Y-axis: 80 to 95.

Download button: Download

Screenshot: 5

**Clicking on Download(image)**

Browser: localhost:8769/Climaa/index2.html

Dialog: The page at localhost:8769 says: insert name of file to save in png. Input: clima\_temp. Buttons: OK, Cancel.

Table (background):

MONTH	TEMP_MAX	YEAR
Jan	84.774	2000
Feb	88.986	2000
Mar	92.061	2000
Apr	94.064	2000
May	90.907	2000
Jun	84.078	2000
Jul	82.699	2000
Aug	82.791	2000

Chart (background): Filter By: C, F. Legend: 2000 (blue), 2001 (grey), 2002 (red). X-axis: January to December. Y-axis: 80 to 95.

Download button (background): Download

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Screenshot: 6

localhost:8769/Climaa/index2.html

Find

Precipitation  
 Min Temp  
 Max Temp  
 Avg Temp

MONTH	TEMP_MAX	YEAR
Jan	84.774	2000
Feb	88.986	2000
Mar	92.061	2000
Apr	94.064	2000
May	90.907	2000
Jun	84.078	2000
Jul	82.699	2000
Aug	82.791	2000

Filter By:  C  F

Download

Data Tables  Stacked Bar

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clima\_temp.png

Show all downloads...

Screenshot: 7

Png Image downloaded:

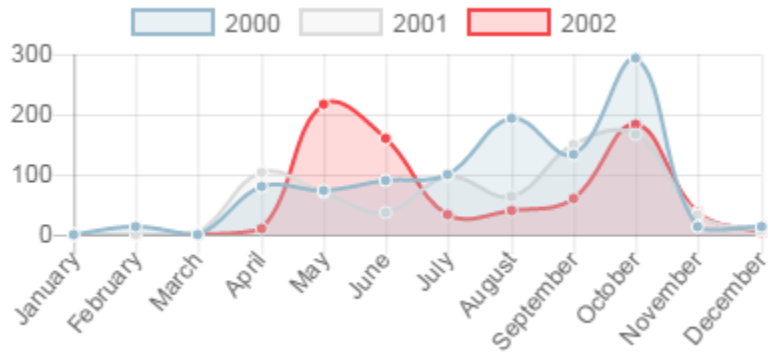


Figure:4

## Pdf Downloaded

The screenshot shows the Adobe Acrobat Reader DC interface. The main content area displays a table with a green header row containing the text "dsfsf". The table has three columns: Year, Month, and Precipitation. The data rows are as follows:

Year	Month	Precipitation
2000	Jan	0.037
2000	Feb	11.832
2000	Mar	0.074
2000	Apr	80.108
2000	May	73.289
2000	Jun	89.692
2000	Jul	99.856
2000	Aug	193.458
2000	Sep	132.482
2000	Oct	291.835
2000	Nov	13.405
2000	Dec	14.699
2001	Jan	0.456
2001	Feb	0.117
2001	Mar	3.645

On the right side, the "Export PDF" sidebar is open, showing options to convert the PDF to Microsoft Word (.docx) format. The document language is set to English (U.S.).

Screenshot:8

## Clicking on Download(content)

The screenshot shows a web application interface for climate data. At the top, there are filters for "Karnataka", "Bangalore", "2000", and "2002", along with a "Find" button. Below the filters, there are two main sections: "TABLE" and "CHART".

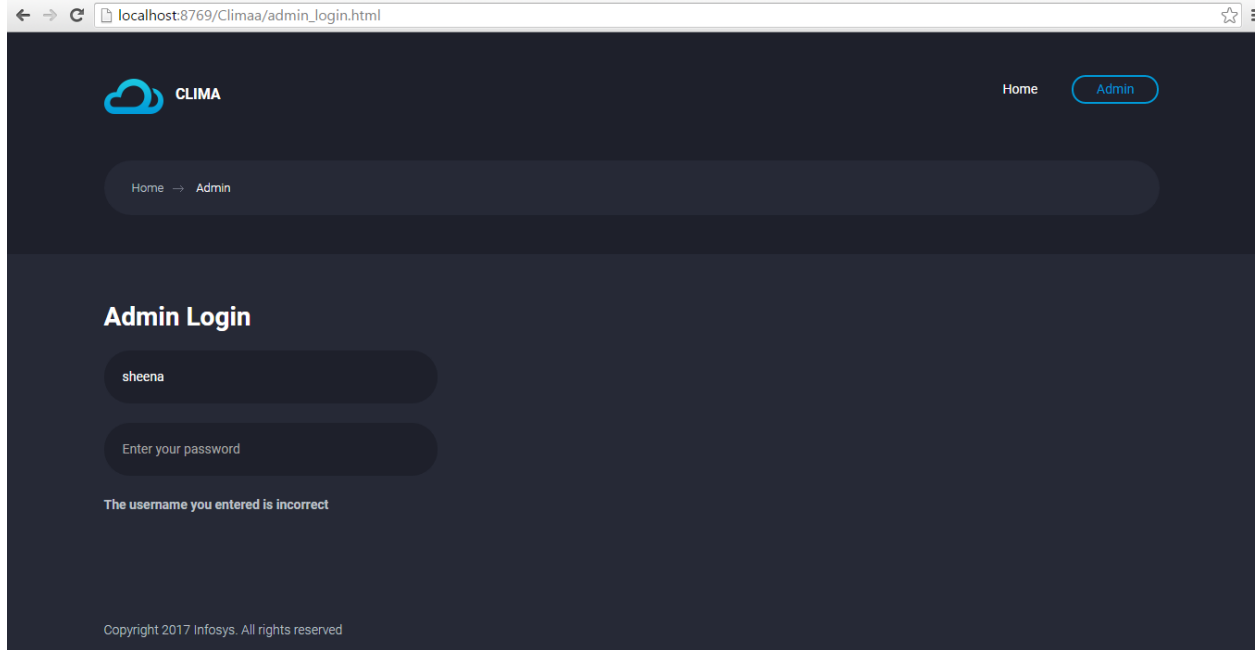
The "TABLE" section displays a table with columns for MONTH, TEMP\_MAX, and YEAR. The data rows are as follows:

MONTH	TEMP_MAX	YEAR
Jan	84.774	2000
Feb	88.986	2000
Mar	92.061	2000
Apr	94.064	2000
May	90.907	2000
Jun	84.078	2000
Jul	82.699	2000
Aug	82.791	2000

The "CHART" section displays a bar chart showing temperature data for the years 2000, 2001, and 2002. The chart includes a legend for "Data Tables" and "Stacked Bar", and a "Filter By:" section with options for "C" and "F". There are "Download" buttons for the table and chart content, with a specific "Download r.pdf" button for the table.

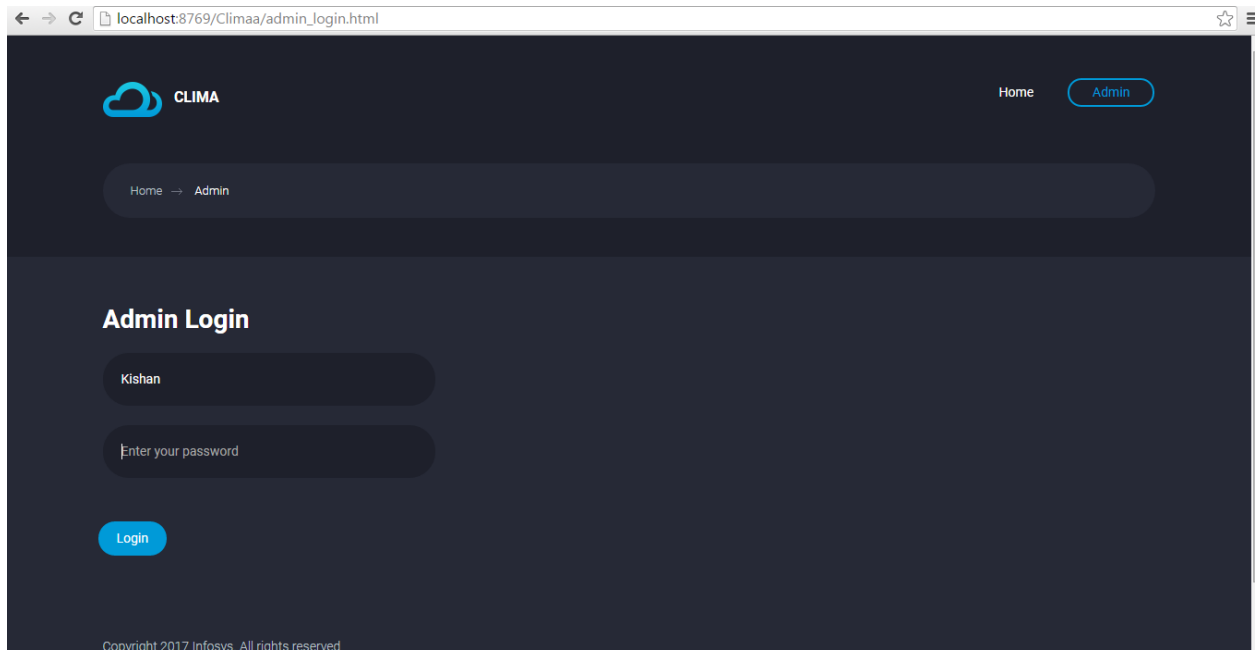
Screenshot: 9

### AdminPage wrong username entered:



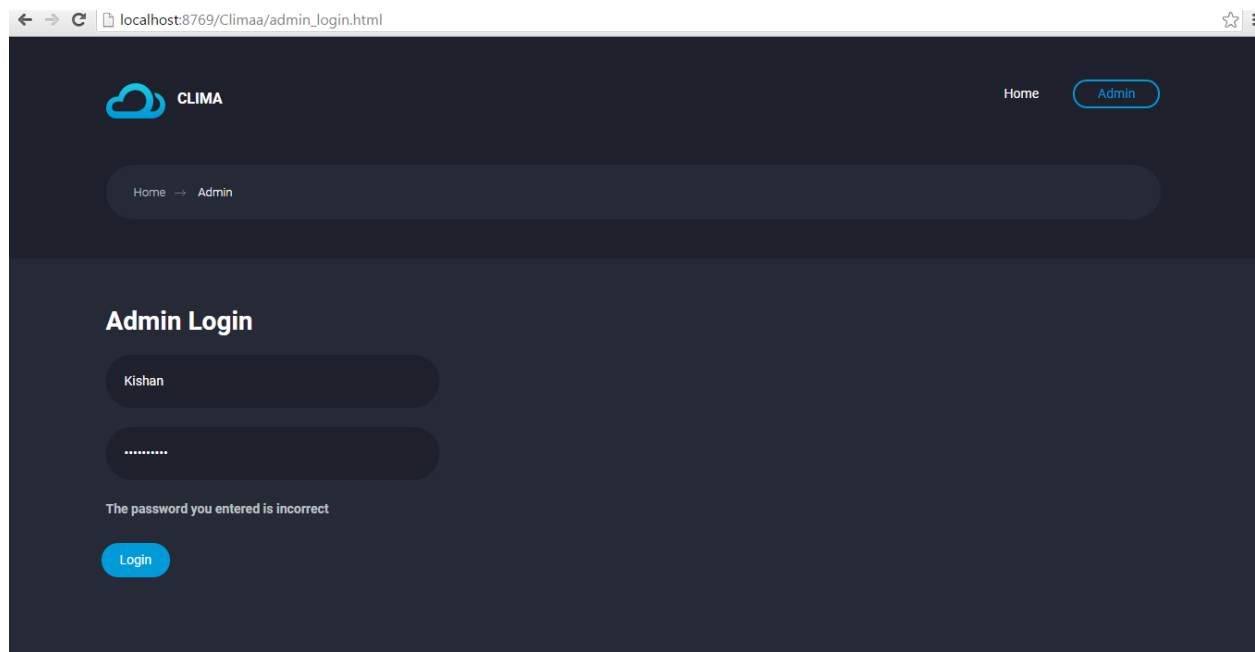
Screenshot: 10

### AdminPage correct username entered:



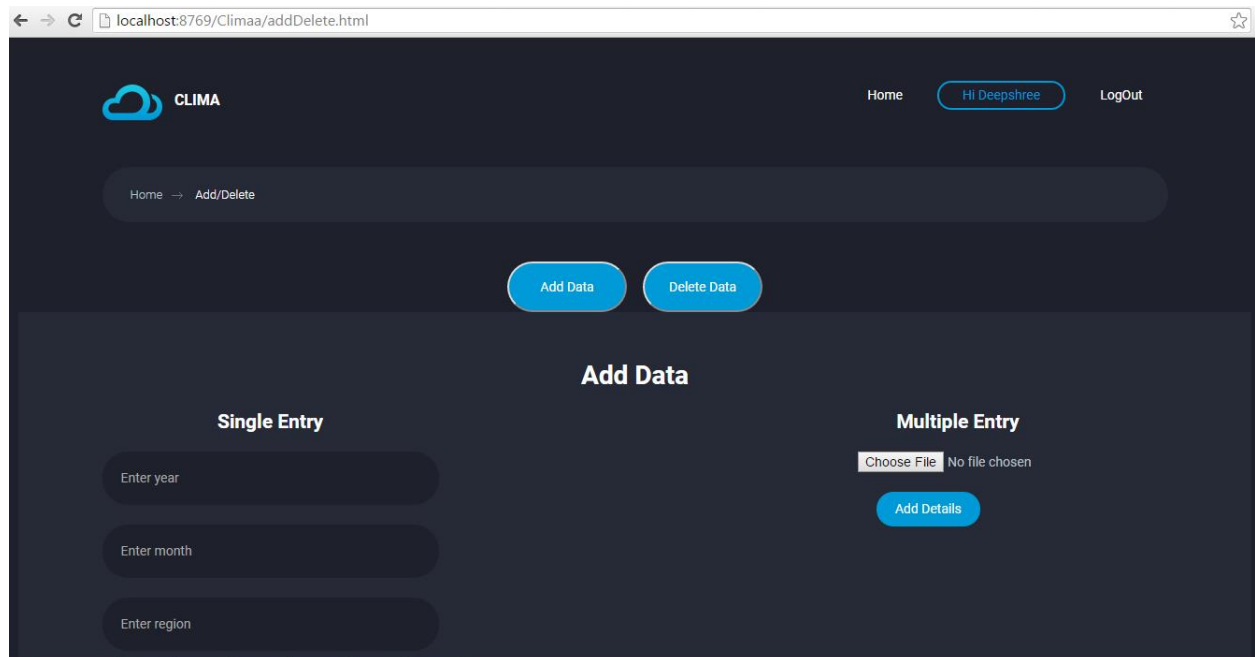
Screenshot: 11

## AdminPage wrong password entered:



Screenshot: 12

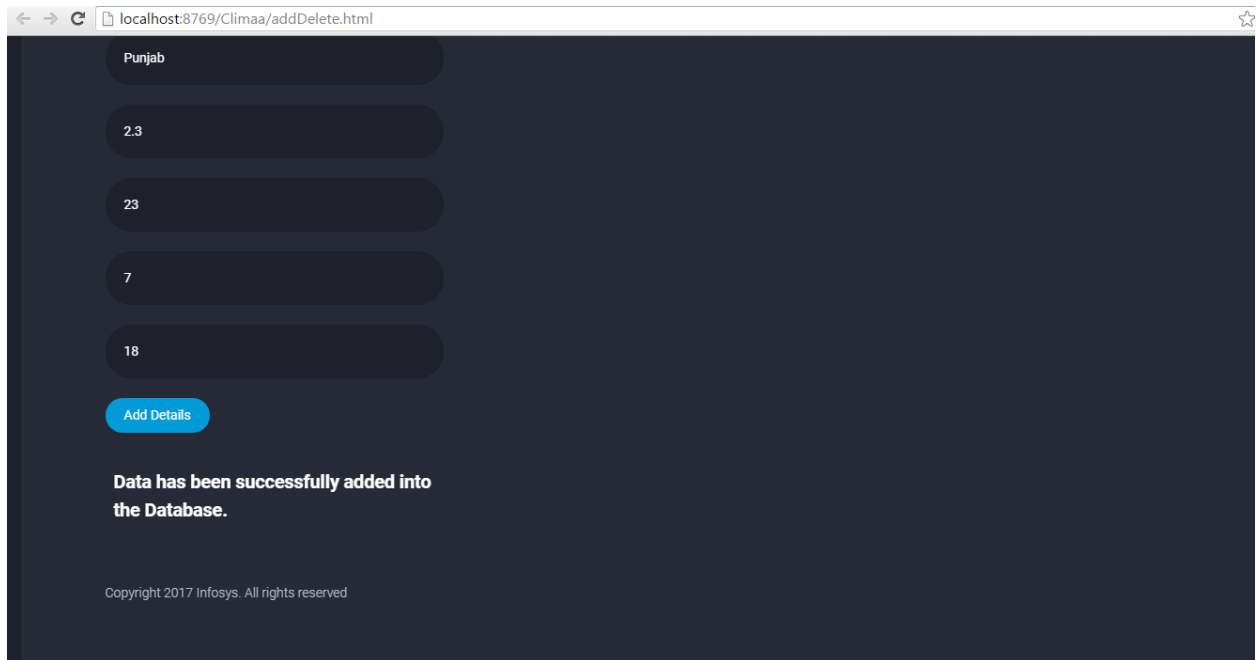
## AdminPage correct password entered:



Screenshot: 13



## AddDelete Single Form Entry:



localhost:8769/Climaa/addDelete.html

Punjab

2.3

23

7

18

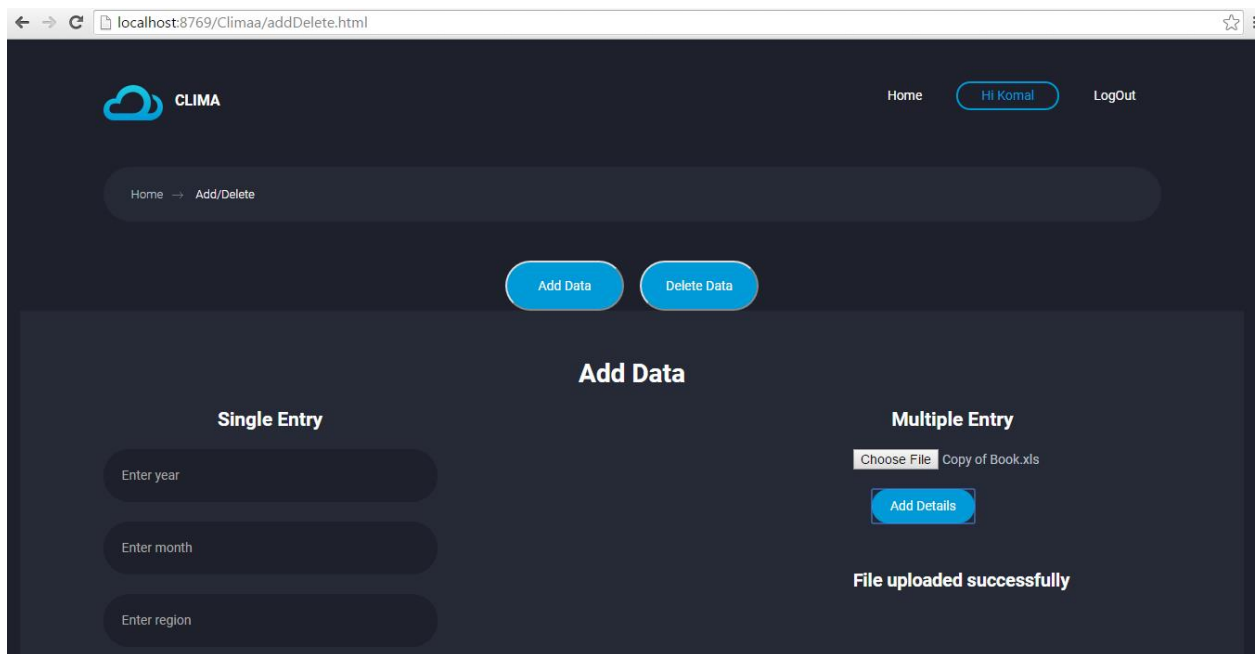
Add Details

Data has been successfully added into the Database.

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Screenshot: 14

## AddDelete Multiple Form Entry(Successful Upload):



localhost:8769/Climaa/addDelete.html

CLIMA

Home Hi Komal Logout

Home -> Add/Delete

Add Data Delete Data

Add Data

Single Entry

Enter year

Enter month

Enter region

Multiple Entry

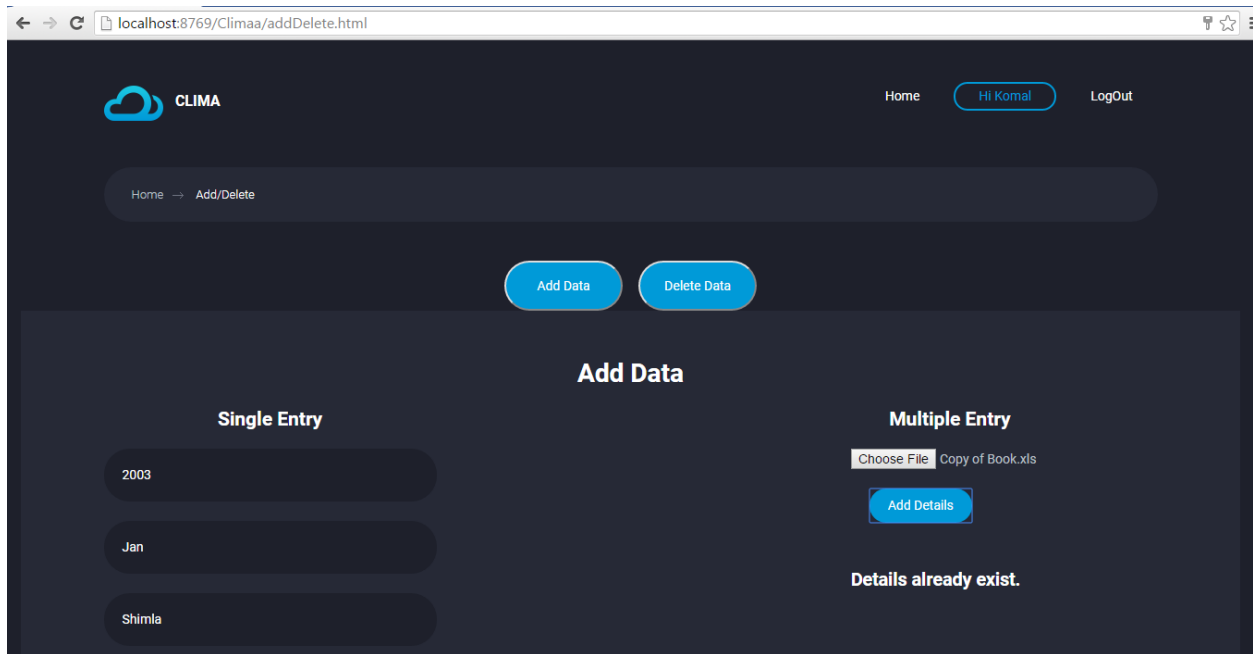
Choose File Copy of Book.xls

Add Details

File uploaded successfully

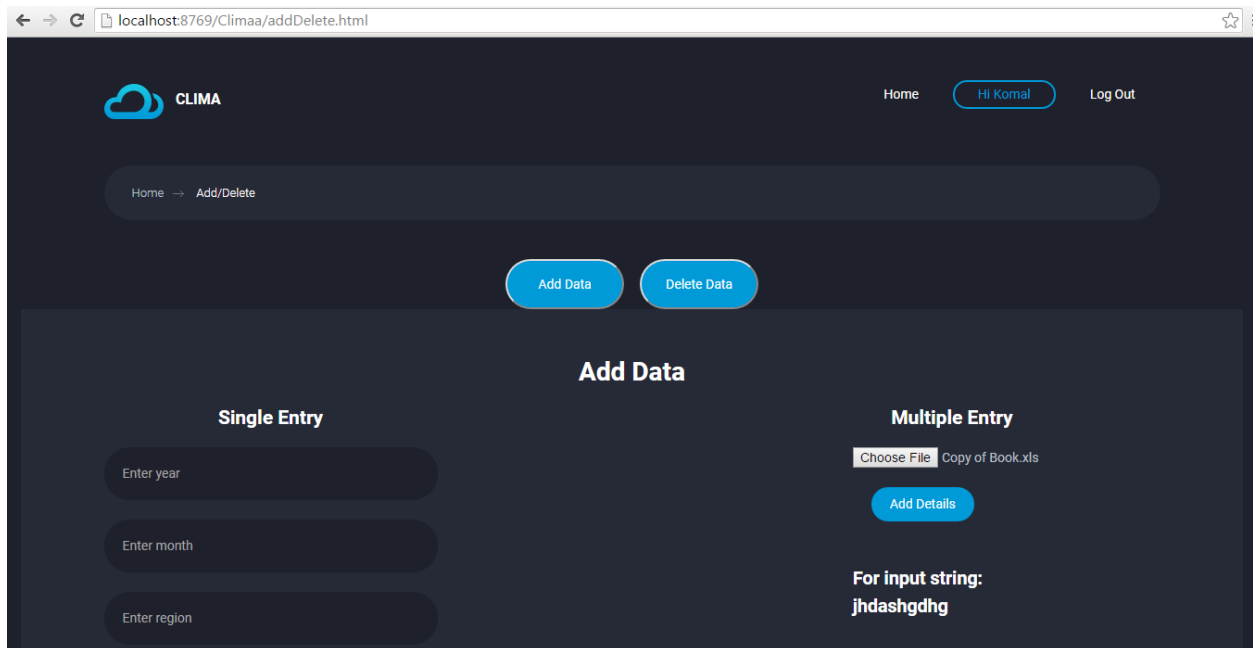
Screenshot: 15

## AddDelete Multiple Form Entry(Details exists already):



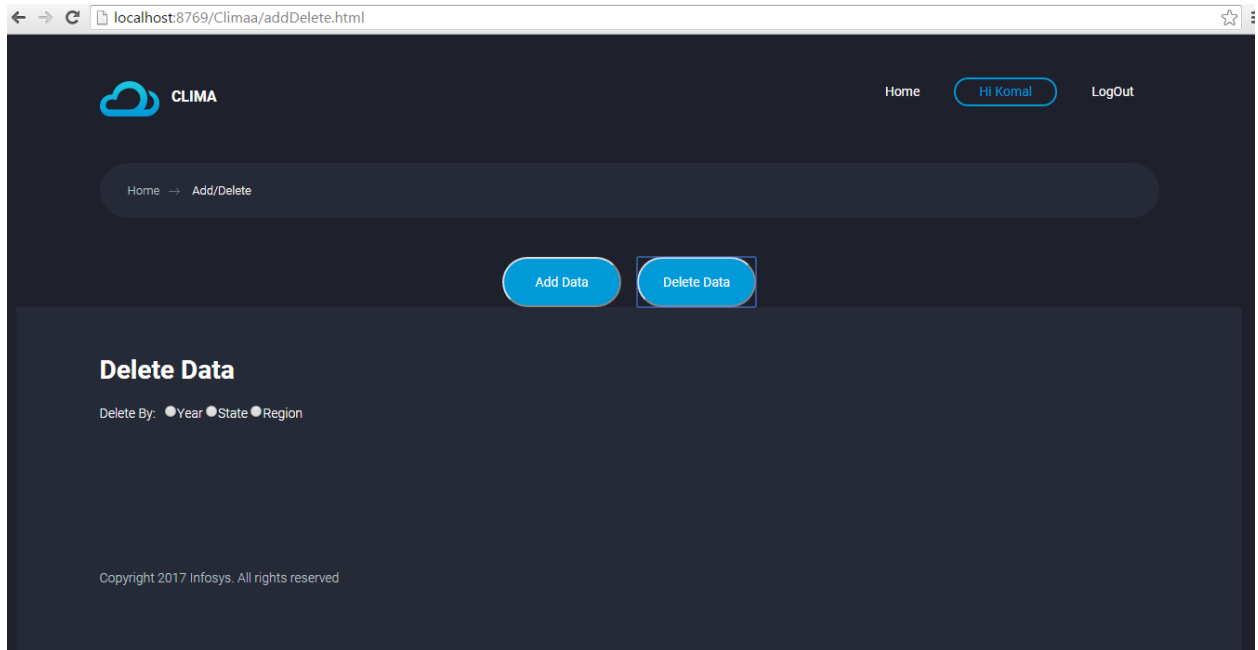
Screenshot: 16

## AddDelete Multiple Form Entry(Incorrect Format):



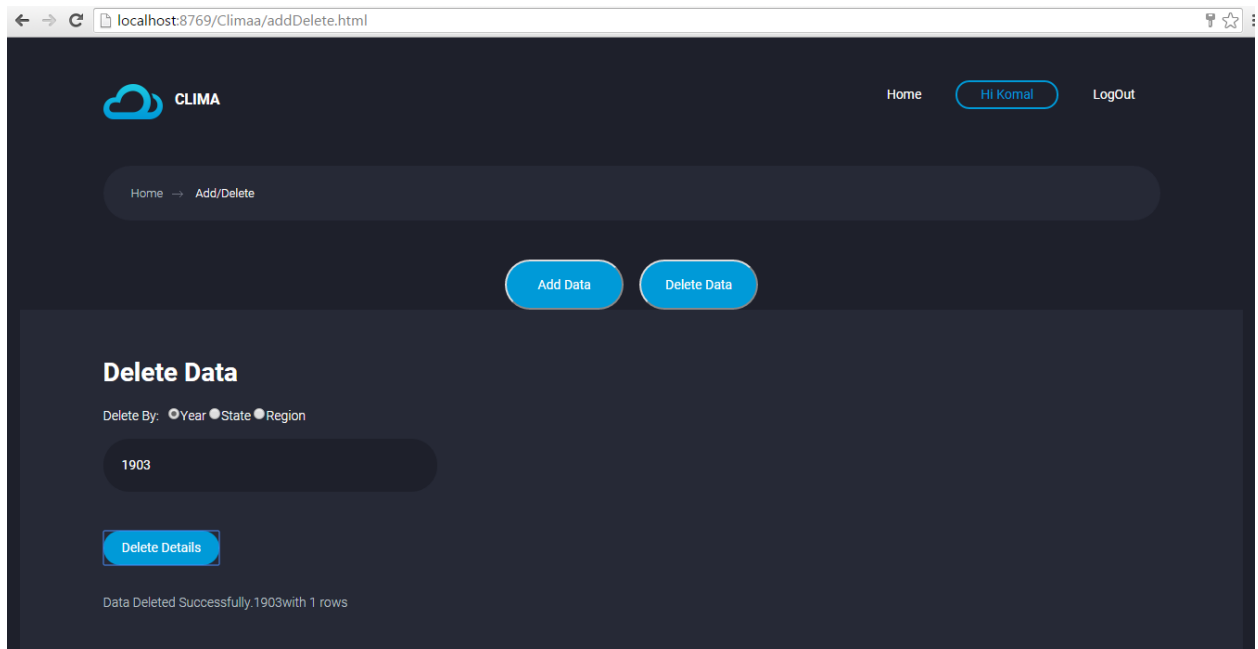
Screenshot: 17

## AddDelete Delete Entry:



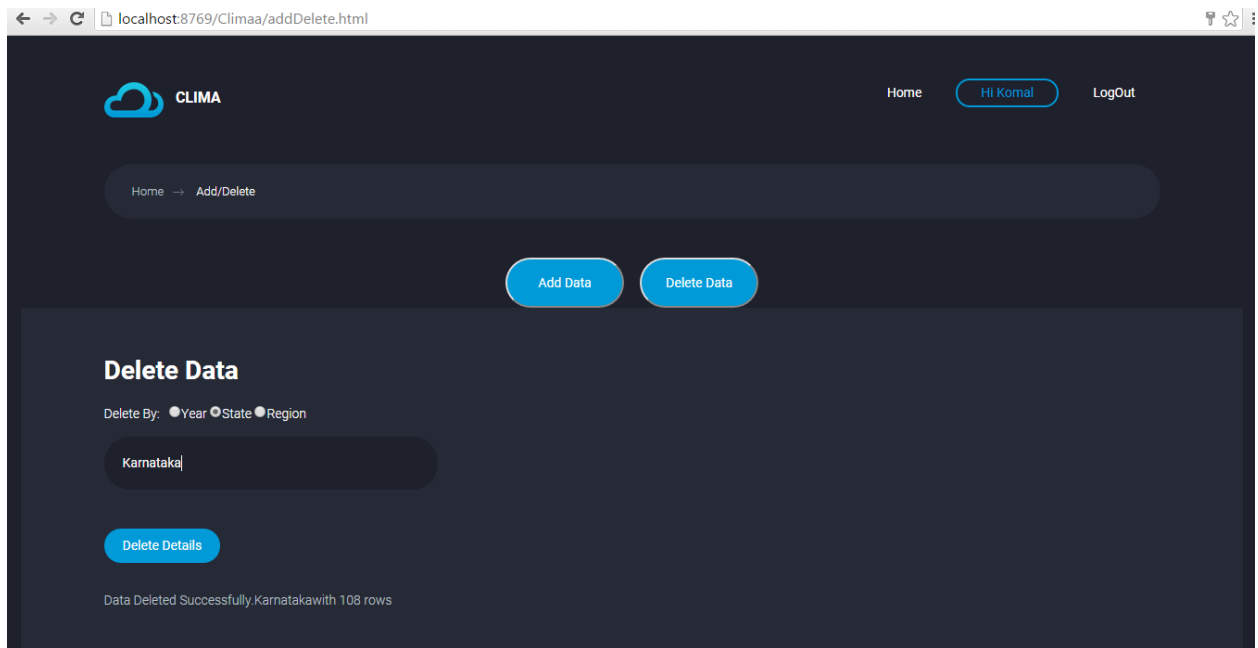
Screenshot: 18

## AddDelete Delete Entry(Delete by Year):



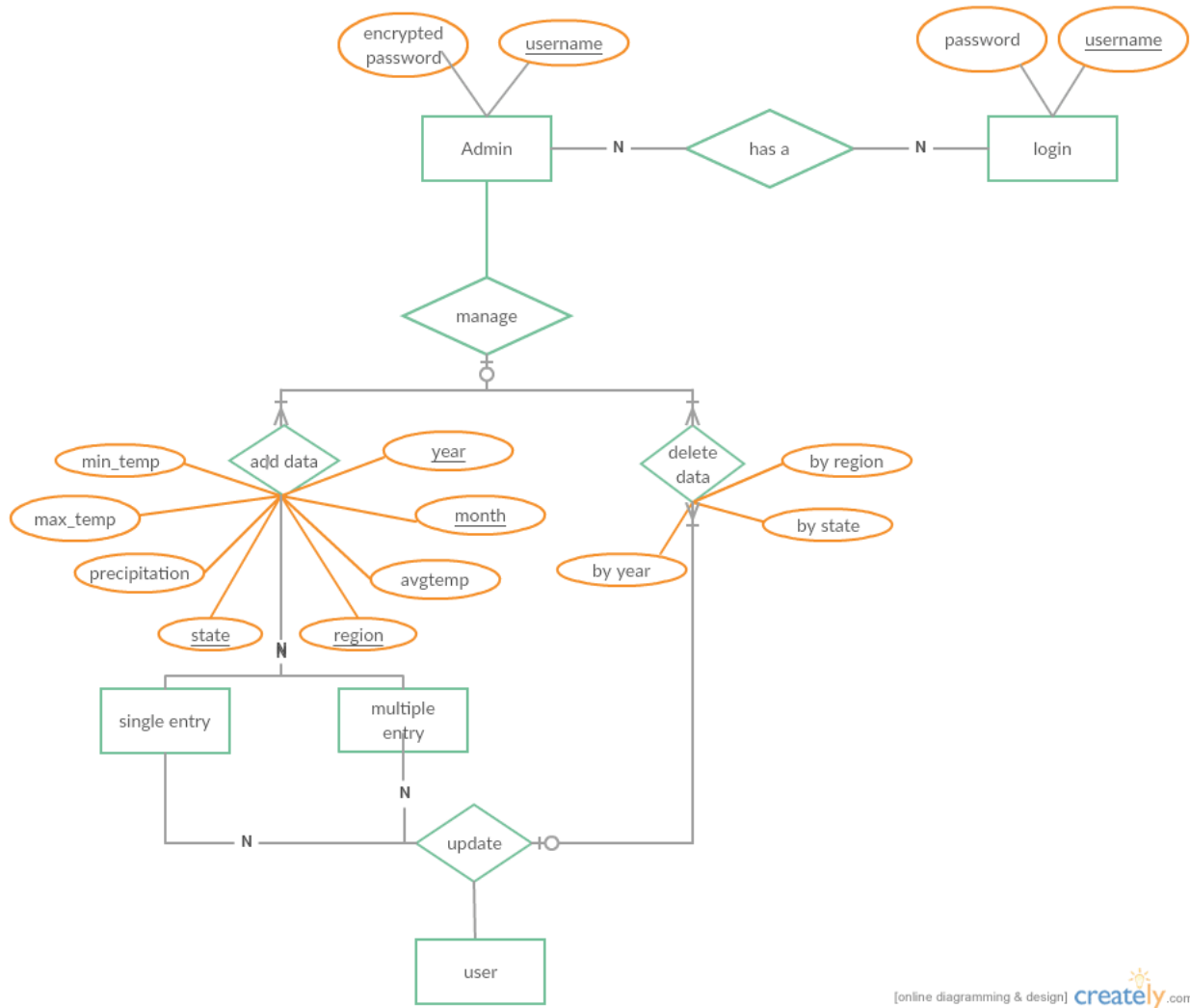
Screenshot: 19

## AddDelete Delete Entry(Delete by Year):



Screenshot: 20

## CHAPTER-4 ORGANIZATION OF DATABASE



[online diagramming & design] [createiy.com](http://createiy.com)

Figure: 5

### TABLES/FILES OR ENTITIES

Name :Location

Synonym name :LocationEntity

Description :Details of various states and region along with the parameters

Indexing parameters :

Clustering parameters :

Attributes/Fields :

No	Field Name	Description	Size	Type	Optional/Mandatory?	Occurs (Instances of attribute)	Default values
1	list_year	It stores the year value.	4	INT	mandatory		no
2	list_month	It stores the month value.	3	VARCHAR	mandatory		no
3	list_precipitation_m	It stores the precipitation value	20	VARCHAR	optional		no
4	list_region	It stores the region of various states	20	VARCHAR	mandatory		no
5	list_state	It stores two particular states	20	VARCHAR	mandatory		no
6	list_temp_max	It stores the maximum temperature of the region	20	VARCHAR	optional		no
7	list_temp_avg	It stores the average tempera	20	VARCHAR	optional		no

		ture of the region					
8	list_temper_minn	It stores the average temperature of the region	20	VARCHAR	optional		no

Table:2

Name :AdminDetails

Synonym name :AdminEntity

Description :Details of username and password of admin

Indexing parameters :

Clustering parameters :

Attributes/Fields:

No.	FieldName	Description	Size	Type	Optional/Mandatory	Occurs	Default Values
1	Username	Stores the unique username for admin	20	Varchar	Mandatory		No
2	Password	Stores the password for each username	20	Varchar	Mandatory		No

Table:3

## **CHAPTER 5**

### **CONCLUSION**

It is concluded that application serves the purpose of analyzing the data of different states and region. The application is properly tested and make it user friendly and easy to use. The application designed meet functional as well as non functional requirement. The application aims to provide tabular data and charts of different location .

But the system deals with some limitations. Our project initially contains the details of only two particular location i.e. Chandigarh and Karnataka. Also, the project deals with only two types of chart- Line chart and stacked bar chart. We can also add different types of charts to enhance attractiveness to our project.

1. Better UI (User Interface) can be given to the program to enhance easy to use purpose.
2. Adding new feature of showing the future trends of various places.
3. Providing user the ability to compare two different places by viewing the two places simultaneously.



## **5.1) Future Scope**

On the basis of the analysis of performance of our application we can predict that it will stand by all the requirements and expectations of the user.

Considering the future use and scope of the application, we can say that it will be used by the user to view different locations data and be able to make analysis on that data.