

**Tribhuvan University**

**Faculty of Humanities and Social Science**

**A Report on Temperature Prediction**

**Using Linear Regression**

**A Report Submitted to**

Department of Computer Applications

Asian College of Higher Studies

***In partial fulfillment of the requirements for the Bachelors in Computer Applications***

**Submitted by**

Dipendra Adhikari

Under the Supervision of

Pesal Rai



**Tribhuvan University**

**Faculty of Humanities and Social Sciences Asian College of Higher Studies**

# Supervisor’s Recommendation

I hereby recommend that this project prepared by Dipendra Adhikari entitled “**Temperature Prediction ”** in partial fulfillment of the requirements for the degree of Bachelor of Computer Application is recommended for the final evaluation.

………………………..

Pesal Rai

###### Supervisor

Humanities and social science

Asian College of Higher Studies



**Tribhuvan University**

**Faculty of Humanities and Social Sciences Asian College of Higher Studies**

**LETTER OF APPROVAL**

This is to certify that this project prepared by Dipendra Adhikari entitled “**Temperature Prediction”** in partial fulfillment of the requirements for the degree of Bachelor in Computer Application has been evaluated. In our opinion, it is satisfactory in the scope and quality as a project for the required degree.

|  |  |
| --- | --- |
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**Abstract**

Temperature prediction plays a crucial role in various sectors such as agriculture, energy management, and urban planning. Accurate temperature forecasting can help in making informed decisions and optimizing resources. This project focuses on the development of a temperature prediction system using linear regression for 7 provinces of Nepal. The goal is to create a model that predicts both minimum and maximum temperatures based on historical weather data.

***Keywords:*** *Temperature Prediction, Linear Regression ,PHP, HTML ,CSS*

# Acknowledgement

I would like to express my gratitude to supervisor, Mr. Pesal Rai for assisting in learning about weather prediction for this project “**Temperature Prediction**”. He provided me with the opportunity to work on this project, which has allowed me to learn a lot of new things about algorithm, and I am grateful to my professor for that.

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Table of Contents

[Chapter 1: Introduction 1](#_Toc180997313)

[1.1. Introduction 1](#_Toc180997314)

[1.2. Problem Statement 1](#_Toc180997315)

[1.3 Objectives 2](#_Toc180997316)

[1.4 Scope and Limitation 2](#_Toc180997317)

[Chapter 2: Background Study and Literature Review 2](#_Toc180997318)

[2.1 Background Study 4](#_Toc180997319)

[2.2 Literature Review 4](#_Toc180997320)

[Chapter 3: System Analysis and Design 6](#_Toc180997321)

[3.1 System Analysis 6](#_Toc180997322)

[3.2 System Design 9](#_Toc180997323)

[3.3 Algorithm Detail 10](#_Toc180997324)

[Chapter 4: Implementation and Testing 13](#_Toc180997325)

[4.1. Implementation 13](#_Toc180997326)

[4.2. Testing 13](#_Toc180997327)

[Chapter 5: Conclusion and Future Recommendations 17](#_Toc180997328)

[5.1 Lesson Learnt 17](#_Toc180997329)

[5.2 Conclusion 17](#_Toc180997330)

[5.3 Future Recommendation 18](#_Toc180997331)

[References 18](#_Toc180997332)

[Appendices 19](#_Toc180997333)

# List of Figures

Figure 3.1 : Use Case Diagram of Temperature Prediction ................................................6

Figure 3.2 : ER Diagram ......................................................................................................8

Figure 3 .3: Level 0 DFD .....................................................................................................8

Figure 4 .4: Level 1 DFD .....................................................................................................9

Figure 5 .5: Architectural Design .......................................................................................10

# List of Tables

4.2. 1 :Test Case of Prediction ........................................................................................... 14

4.2. 2 :Admin Login...........................................................................................................16

# List of Abbreviations

CSS Cascading Style Sheet

DFD Data Flow Diagram

ERD Entity Relation Diagram

HTML Hypertext Markup Languages

PHP HyperText Preprocessor

SQL Structured Query Language

# Chapter 1: Introduction

## 1.1. Introduction

Temperature prediction is a critical aspect of weather forecasting with significant implications for various industries and everyday life. Accurate temperature forecasts enable informed decision-making in sectors like agriculture, energy consumption, and disaster preparedness. This project focuses on developing a temperature prediction system for 7 provinces of Nepal, utilizing the linear regression algorithm to forecast both minimum and maximum temperatures. [1]

Being the himalayan nation, Nepal experiences diverse climatic conditions due to its geographical location and elevation. The temperature variations have a direct impact on activities such as agriculture, tourism, and urban planning. The ability to predict temperature changes with accuracy can provide valuable insights for local authorities, businesses, and individuals. [2]

The main objective of this project is to create a reliable temperature prediction model using linear regression, a straightforward yet effective statistical technique. By analyzing historical weather data, the model will establish relationships between temperature and various factors like date, time of year, and potentially influencing meteorological parameters.

## 1.2. Problem Statement

Nepal experiences diverse temperature fluctuations throughout the year due to its geographical characteristics and elevation. Accurate temperature prediction is essential for various sectors, including agriculture, tourism, energy management, and disaster preparedness. However, existing temperature prediction methods may lack the precision required to cater to the city's specific climatic patterns.

The problem at hand is to develop a reliable temperature prediction system for 7 provinces that utilizes the linear regression algorithm to forecast both minimum and maximum temperatures.

## 1.3 Objectives

The main objectives of this project are:

* To develop accurate prediction model.
* To identify the most relevant features that influence temperature changes

## 1.4 Scope and Limitation

1.4.1 Scope

Scopes are:

* Geographical Scope
* Temperature Range
* Temporal Resolution

1.4.2 Limitation

* Not great for really long time
* Needs Update
* Data Limitations

**1.5 Report Organization**

Chapter 1: Introduction

It includes the introduction of the project where problem statement, objective of the project along with the scopes and limitations of the project are listed which will provide a general concept of the project to the reader.

# Chapter 2: Background Study and Literature Review

It includes background study and literature review of a similar project and concepts of the current project.

Chapter 3: System Analysis and Design

It contains the workings of the project including feasibility analysis, functional and nonfunctional analysis along with the schema and architectural design and the data and process modeling diagrams.

Chapter 4: Implementation and Testing

It includes the testing and implementation phase of the project i.e. it includes designing of test cases to check if the system and its components work as intended during development.

It also contains tools that were used in the construction of the project.

Chapter 5: Conclusion and Future Recommendation

It contains the conclusion of the entire project. In this chapter, outcome of the project is noted along with the things learnt from the creation of the project. In addition to these things the future recommendations of the project are also listed in the end of chapter 5.

**Chapter 2: Background Study and Literature Review**

## 2.1 Background Study

Temperature prediction using linear regression is a significant application of data analysis and statistical modeling, particularly in the field of meteorology and climate science. Linear regression is a fundamental statistical method used to model the relationship between a dependent variable (in this case, temperature) and one or more independent variables (such as time, season, and weather patterns). This approach is widely utilized due to its simplicity and interpretability.

Meteorologists and climate scientists have been using linear regression to predict temperatures for decades. The background study for temperature prediction using linear regression involves understanding the following key aspects:

1.Linear Regression

2.Data Collection

3.Model Training and Evaluation

4.Scope and Limitation

## 2.2 Literature Review

The literature review on temperature prediction using linear regression reveals a wealth of studies showcasing the effectiveness and limitations of this approach within the realm of meteorology, climate science, and related fields. Researchers have extensively explored various aspects of linear regression-based temperature prediction, highlighting its applications, methodologies, advancements, and comparisons with other predictive techniques. [1]

This study focuses on applying linear regression models for weather forecasting. The authors analyze historical weather data and relevant atmospheric variables to develop models that predict temperature, humidity, and precipitation. The study demonstrates the effectiveness of linear regression in providing accurate forecasts and highlights the importance of feature selection and model validation techniques. [1]

This research explores the use of logistic regression for weather event prediction. The authors develop logistic regression models to forecast the occurrence of rain, snow, and thunderstorms. They utilize historical weather data and relevant meteorological variables to train the models. The study highlights the significance of model evaluation and discusses the limitations and challenges associated with logistic regression in capturing complex weather phenomena. [2]

Additionally, advancements in linear regression-based temperature prediction have come to the forefront. Machine learning techniques, such as Ridge and Lasso regression, have been integrated to address multi collinearity and improve model robustness [3] . Moreover, hybrid models combining linear regression with data from advanced climate simulations have been developed to predict temperatures under different climate scenarios, [4]

In summary, the literature review underscores the significance of linear regression in temperature prediction by emphasizing its practical applications, advancements, and incorporation of machine learning techniques. While its limitations are evident in capturing non-linear trends, its role remains pivotal in providing interpretable and effective temperature forecasts, especially when combined with hybrid models and data from climate simulations. Comparisons with other techniques reinforce the value of linear regression within the broader landscape of temperature prediction research.Yahoo! News, launched in 1996, was an early example of a comprehensive news portal that featured original content alongside aggregated news articles. Yahoo! employed a combination of human editors and algorithms to curate and organize news content based on categories and user interests.

# Chapter 3: System Analysis and Design

# 3.1 System Analysis

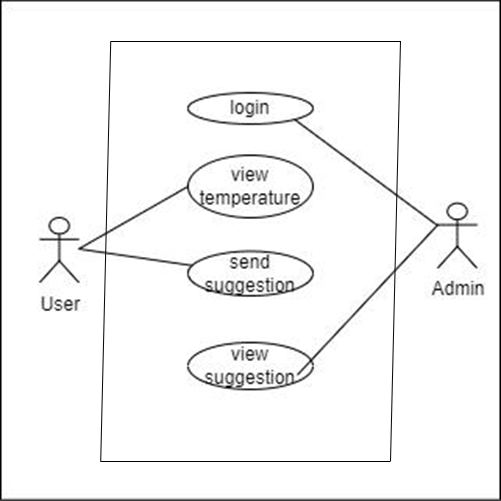
System analysis is conducted for studying a system or its parts in order to identify its objectives. A problem-solving technique improves the system and ensures that all the components of the system work efficiently.

##### 3.1.1 Requirement Analysis

Functional requirement defines a function of a system or its component. A function is described as a set of inputs, the behavior, and outputs. It may be calculations, technical details, data manipulation and processing and other specific functionality that define what a system is supposed to accomplish.

###### Functional Requirement

###### Figure 3.1: Use Case Diagram of Temperature Prediction



The above figure shows the use cases of the system. It shows the user and admin can do the following things such as user can see the temperature and send the message to admin and incase of admin it can login and respond to the message of user.

###### ii. Non-Functional Requirements

A non-functional requirement is a requirement that specifies criteria that can be used to judge the operation of a system, rather than specific behaviors. They are contrasted with functional requirements that define specific behavior or functions.

* Performance: The system should be able to process and analyze large volumes of data within acceptable time frames to generate timely forecasts. .
* Reliability: The system should be reliable and available, ensuring that forecasts are consistently accessible.
* Accuracy: Weather forecasts should strive for a high degree of accuracy and precision.

3.1.2 Feasibility Analysis

A feasibility analysis is an analysis that considers all of a project's relevant factors including economic, technical, legal, and scheduling considerations to ascertain the likelihood of completing the project successfully.

Before building the system following feasibilities were studied to determine the viability of the system such as ensuring a project is legally and technically feasible as well as economically justifiable.

* Technical Feasibility:

To design, code, test, deploy and maintain the system there are enough software, hardware and network resources. There is not any technological

difficulty to build the system.

* Operational Feasibility:

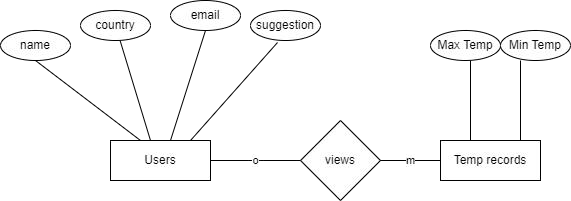
The system will be user friendly and all the requirements will be met and the problems identified will be solved. So, it is operationally feasible.

* Economic Feasibility:

We will be using open-source technologies so the system is economically feasible. So there is no recurring cost.

3.1.3. Data Modeling ER Diagram

###### Figure 3.2: ER Diagram of Temperature Prediction

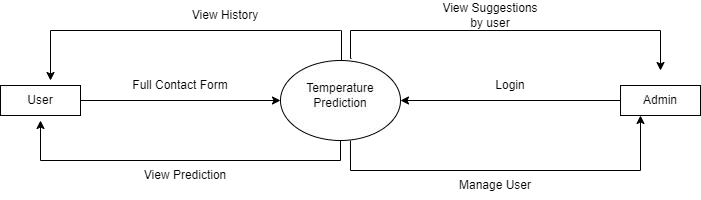


Here in above figure, we can see the ER Diagram of the system ,where the users can contact with the admin and give the feedback /suggestion to the admin so that the admin can know the area where he can improve. The user can view the minimum and maximum temperature of Kathmandu that is recorded in the csv file.

**3.1.4. Process Modelling DFD**

###### Level 0 DFD

**Figure 3.3: Level 0 DFD of Temperature Prediction**

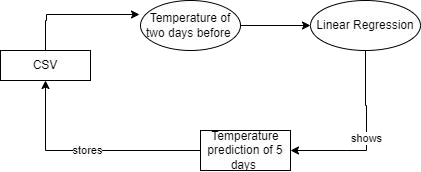


Here in the above figure, we can see the Level 0 DFD of our system where the user is able to perform the operations provided by Temperature Prediction system to the user.

The user will be able to view the temperature and fill contact for the suggestions. User will be able to view history of temperature managed by the admin. Admin will manage users and manage the history.

###### Level 1 DFD

**Figure 4.4: Level 1 DFD of Temperature Prediction**

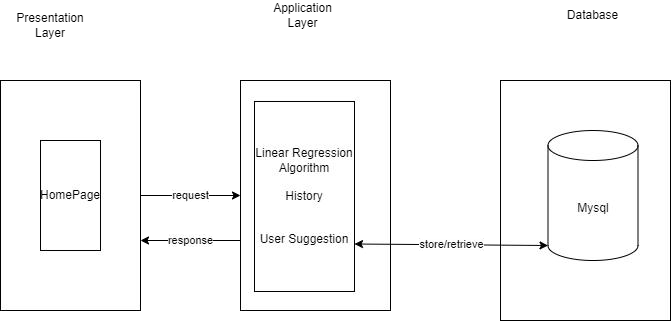


The figure above demonstrate level 1 DFD of the system. According to above level 1 dfd , csv file gives the two days before temperature and it is provided to linear regression algorithm. The algorithm shows the predicted temperature of 5 days which is stored in the csv file.

## 3.2 System Design

3.2.1 Architectural Design

**Figure 5.5: Architectural Design of Temperature Prediction**



Here, in the architecture design, there are three layers i.e,Presentation Layer, Application Layer and Database Layer. Presentation Layer consists of a homepage where the user can see the temperature. In the Application Layer there is an algorithm which shows the temperature predicted. And in the database layer the user suggestion is stored.

### 3.3 Algorithm Detail

**Linear Regression**

Linear Regression is a machine learning algorithm used for the prediction of parameter which is in continuous nature. In this project, linear regression has been used for forecasting the minimum and maximum temperature.

Major objectives of Linear Regression Function: Linear regression has been used for the following objectives:

• In order to find the relationship among variables (here maximum temperature and minimum temperature)

Simple linear regression is used to predict daily minimum and maximum temperatures based on the temperature two days before. The linear regression formula for a simple linear regression model is as follows:

Slope (m):

m=

Intercept (b):

b =

Where,

* is number of data points.
* X is the input feature (temperature two days before).
* Y is the output (minimum or maximum temperature).

​

The train method in the Linear Regression class calculates the slope (m) and intercept (b) using the above formulas based on the provided training data (X and y).

The predict method in the Linear Regression class predicts the output (Y) based on a given input (X) using the formula for a line:

Y=mX+b

In this case, Y represents the predicted minimum or maximum temperature, and X is the temperature two days before. for eg:

Given data for Maximum Temperature (Y\_max) and Minimum Temperature (Y\_min):

1.Maximum temperature (Y\_max):

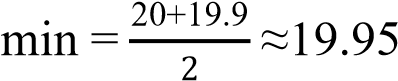
Day 1 (2024-10-18): 29°C Day 2 (2024-10-19): 29.2°C

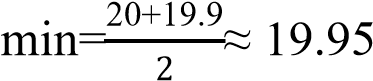
2.Minimum temperature (Y\_min):

Day 1 (2024-10-18): 20°C Day 2 (2024-10-19): 19.9°C

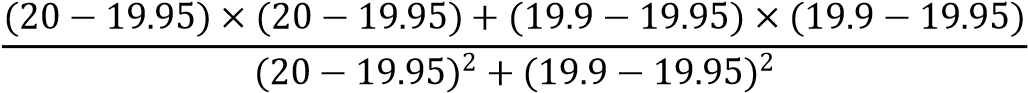
For Minimum Temperature (Y\_min):

1.Calculate X̄ and Ȳ

Xˉ

Yˉ

Calculate the slope (m\_min):

min = 

min ≈0.1

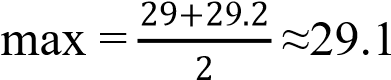
Calculate the intercept (b\_min):

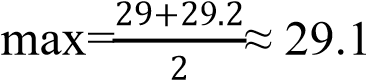
min=19.95−(0.1×19.95)

min≈18.955

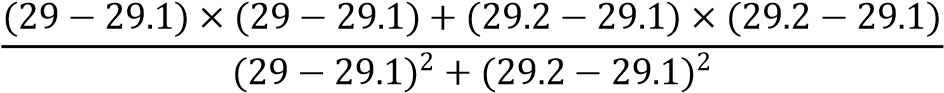
For Maximum Temperature (Y\_max):

Calculate X̄ and Ȳ:

Xˉ

Yˉ

Calculate the slope (m\_max):

max = 

max ≈−0.05

Calculate the intercept (b\_max):

max=29.1−(−0.05×29.1)

max≈30.351

The minimum and maximum temperature are 18.955℃ and 30.351℃

Now that we have calculated the slopes and intercepts for both minimum and maximum temperatures, we can use these values to predict temperatures for the next 5 days using the linear regression model.

# Chapter 4: Implementation and Testing

## 4.1. Implementation

##### 4.1.1. Tools Used

* **CASE tools:**
  + **VS code:** We used this tool for coding our project.
  + **XAMPP:** We used Apache & MySQL from this tool to run code and database (MySQL).
* **Programming languages:**
  + **Php:** We have use php for writing this desktop-application.
  + **Java script:** JavaScript was used for client-side scripting and interactivity in the system.
  + **CSS:** CSS was utilized for styling and visual presentation of the system.
* **Database platform:**

**MySQL:** MySQL is used for storing data. It is used as database.

## 4.2. Testing

4.2. 1:Test Case of Prediction

|  |  |  |  |
| --- | --- | --- | --- |
| Date | Data  (Maximum and  Minimum) | Outcome  (Predicted Temperature of  2023-9-22 (max ,min)) | Result |
| 2024-9-12  2024-9-13 | 0 ,0  0 ,0 |  | Pass |

|  |  |  |  |
| --- | --- | --- | --- |
| 2024-9-14  2024-9-15  2024-9-16  2024-9-17  2024-9-18  2024-9-19  2024-9-20  2024-9-21 | 0 ,0  0 ,0  0 ,0  0 ,0  0 ,0  0 ,0  0 ,0  0 ,0 | 0,0 |  |
| 2024-9-12  2024-9-13  2024-9-14  2024-9-15  2024-9-16  2024-9-17  2024-9-18  2024-9-19  2024-9-20  2024-9-21 | 28,20.3  31,19.4  30.1,19.9  30,21  30,21  30,21.8  29,20  29.2,19.9  28,21  28,21 | 27,18.5 | Pass |

#### 4.2.2Admin Login

|  |  |  |  |
| --- | --- | --- | --- |
| Test Case | Test Data | Expected Outcome | Test Result |
| Login | Username:  Password: | Fill all the requirements | Pass |
| Username: useradmin  Password: admin123 | Character must be at  least  8 characters | Pass |
| Username: useradmin  Password: admin123 | Username doesn’t match the filled Are. | Pass |

* **Training Data:**

Historical temperature data from "2024-9-12" to "2024-9-21" for Kathmandu.

* **Training Model:**

Train a linear regression model using the historical data.

* **Test Input:**

Date for prediction: "2024-9-22".

* **Prediction:**

Use the trained model and the assumed features to predict temperatures for "2024-09-22".

* **Output:**

Predicted Minimum Temperature for "2024-09-22": 18.5°C

Predicted Maximum Temperature for "2024-09-22": 27°C  **Expected Output:**

Minimum Temperature for "2024-09-22": 20.5°C

Maximum Temperature for "2024-09-22": 28°C

As for Unit Testing, I have taken the historical data for 10 days i.e, from "2024-9-12" to "2024-9-21" so it can predict the temperature for “2024-9-22”.The result for the prediction of minimum and maximum temperature are 18.5°C and 27°C respectively. Although the Realtime temperature of minimum and maximum temperature are 20.5°C and 28°C respectively.

The temperature predicted may not be accurate with real time due to the geographical variation also.

4.2.2 Test Cases for System Testing

1. **Functional Testing:**

Verified that Admin can successfully register to use the app. Different scenarios is tested for validation purpose. No duplicate username is allowed.

1. **UI Testing:** UI is successfully checked. The buttons are used properly. The input to be filled in is responding as per requirement.
2. **Error Handling:** Messages are shown as per the error. The error of the system as well as user is handled well.

# Chapter 5: Conclusion and Future Recommendations

## 5.1 Lesson Learnt

Through this project, we learnt about the algorithms that can help in building websites. We also get to know about the implementation of algorithm and use of it. This initiative has provided us with a valuable opportunity to enhance our skills and knowledge, leading to a meaningful and enriching learning experiences.

## 5.2 Conclusion

In conclusion, predicting temperatures of 7 provinces is a challenging task due to various factors like geography and climate change. While short-term forecasts are fairly accurate, long-term predictions have more uncertainty. These predictions are crucial for farming, tourism, and disaster planning. To improve accuracy, we need better data and international cooperation. In the end, we must stay prepared for changing temperatures and protect Nepal's unique beauty and culture.

## 5.3 Future Recommendation

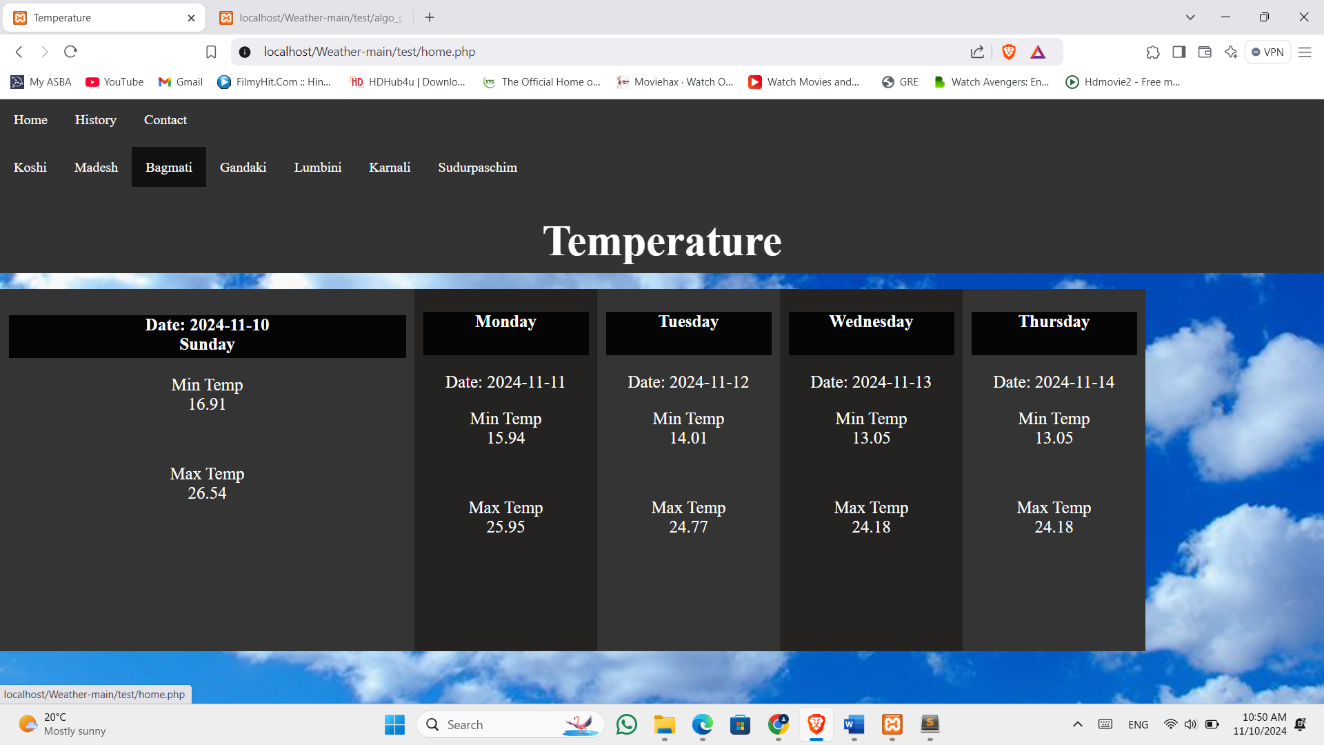
For the future recommendation, inorder to make temperature predictions better, use more than just past temperatures. Include things like humidity, wind, and cloudiness in the prediction.

# References

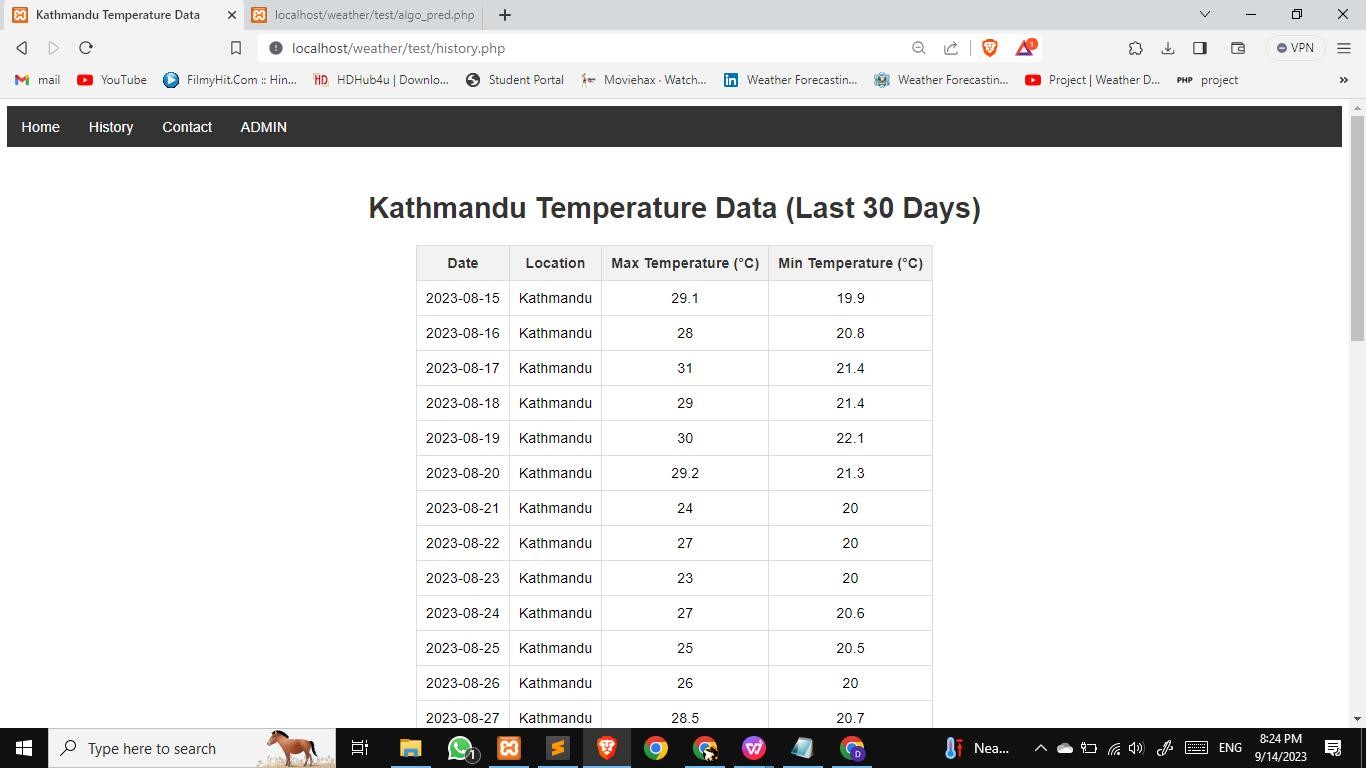
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# Appendices

###### Home



###### History



###### Contact Form

