Weather Report Provider And Location Provider Using Google Map

Rupesh Agarwal
B.Tech CSE
NIET, Greater Noida, India
rupeshagarwal.21sep@gmail.com

Priyanshu Chauhan
B.Tech CSE
NIET, Greater Noida, India
rupeshagarwal.21sep@gmail.com

Ibrar Ahmed
B.Tech CSE
NIET, Greater Noida, India
ibrar.be2012@gmail.com

Abstract— **The purpose of this research title is to present a weather forecast report on various factors and attributes so we can learn more about them such as temperature, wind speed, clouds, sunrise and sunset times, etc. In addition to displaying the correct location, Google Maps makes it easier for people who don't know a particular place and are new to it to understand it more easily, which makes it a great deal easier for them to make any type of decision like traveling to that place. This type of information can be extremely helpful.**

Using our app, the map can be accessed directly to give you directions to a location by using the map feature on Google directly.

One of the biggest benefits of our application is its effectiveness, ease of use, and ability to collect so much information on one page.

Keywords—Weather Forecast, Weather Report, Google Maps, Machine Learning, Data Preprocessing.

I. INTRODUCTION (*HEADING 1*)

The impact of weather on human survival is significant, yet air quality and environmental health have gotten worse due to increased industrialization and automobile use [1]. While satellite weather data offer a real-time picture of the weather, they are not accurate enough for certain locations to be useful for energy-efficient building designs [2]. Precision agriculture powered by technology seeks to optimise crop yield [3], addressing problems such as water waste resulting from improper irrigation scheduling [4]. Real-time field water usage monitoring provides an answer [4].

Accurate and timely weather forecasting is essential for many businesses in a digitally linked society, ranging from disaster relief to agriculture. Our innovative technology makes use of the Internet of Things (IoT) to continuously evaluate environmental factors like temperature and humidity, providing easily accessible real-time data via an intuitive website. Nevertheless, there are issues, such as inconsistent data from several sources and the inconsistent quality of digital weather products [1,2]. Weather forecasting that is accurate affects many aspects of daily life, including transportation, outdoor activities, agriculture, and preparedness for natural catastrophes [3, 4].

Soft computing, a formal academic field since 1990, provides efficient methods for weather forecasting, which is essential given the complexity and quantitative aspect of modern meteorology.

Reliable predictions are the result of a variety of approaches, such as statistical, numerical, and synoptic weather forecasting [5]. Since weather patterns are becoming more unpredictable due to climate change, accurate forecasts are essential for smooth travel and safe operations across the world. Prediction models as they exist now rely on complex physical models and large amounts of processing power [6]. Data is gathered for forecasting by devices such as radars and barometers, which are used in industries ranging from agriculture to aviation [7]. Restrictions persist despite technological advancements, irritating meteorologists everywhere [8].

Our system integrates many weather APIs and data sources to provide comprehensive information on variables such as cloud cover, wind speed, temperature trends, and sunrise/sunset times. It also incorporates Google Maps for weather updates and location-based navigation. Our comprehensive approach aims to increase accessibility and usability and empower people to make educated decisions by giving them relevant and reliable weather information.

II. LITERATURE REVIEW

A. To Let You Know

By giving variables weights, machine learning, a data science approach, builds models using training datasets that allow target values to be predicted. When properly trained, these models provide effective substitutes for conventional weather forecasting techniques. The intricacy and resource requirements of traditional weather stations are reduced when basic machine learning techniques are included into weather prediction, creating a wealth of opportunities for real-time predictions that may be accessed through online services. Furthermore, the Internet of Things (IoT) makes it easier to gather and share meteorological data by utilising networked devices with local intelligence. This method is demonstrated using a small intelligent weather station that uses temperature, wind direction, and speed sensors. Through improved data sensing, recording, and utilisation, the Internet of Things revolutionises meteorology.

Meticulous parameters are monitored by specialised sensors that provide data to the cloud for processing and display. The Internet of Things (IoT)-based weather reporting system allows for long-term weather monitoring and trend prediction in addition to real-time notifications. By combining hardware and software components, IoT platforms like Thing Speak are being developed with the goal of improving accessibility and user engagement. These systems offer user-friendly apps for collecting accurate meteorological information, including tools for geographical mapping. With its improved capabilities for comprehending and adjusting to changing meteorological conditions, this fusion of machine learning and IoT technologies represents a paradigm leap in weather forecasting.

B. Advancements in Weather Forecasting

1. Machine Learning in Weather Forecasting: - Using training datasets, machine learning techniques build predictive models by giving variables weights in order to accurately forecast target values.
- Real-time predictions that are available through online services are made possible by the integration of machine learning into weather forecasting, which provides easier and more resource-efficient alternatives to conventional techniques.

2. Internet of Things (IoT) in Meteorology:

- Compact intelligent weather stations use sensors for temperature, wind speed, and wind direction, showing the role of IoT in real-time data acquisition and dissemination. - IoT enables the gathering and transmission of meteorological data through networked devices with local intelligence.

3. Transformation in Meteorology:

- By improving data sensing, recording, and utilisation, IoT transforms meteorology.
- Meticulous parameters are monitored by specialised sensors, which send data to the cloud for processing and display.
- IoT-based weather reporting systems allow for long-term weather monitoring and trend prediction in addition to providing real-time notifications.

4. Development of IoT Platforms:

Platforms such as ThingSpeak integrate hardware and software components to improve accessibility and user engagement.
- Applications that are easy to use offer comprehensive meteorological data, along with tools for geographical mapping, which enhances user experience and engagement.

5. Research and Future Directions:

The goal of ongoing research is to improve IoT-based weather reporting systems so that they offer more interactive and user-friendly applications.
- Subsequent developments will focus on using gathered data to get a more profound understanding of weather patterns, climatic trends, and the possible effects of climate change on particular areas.

III. RELATED WORK

In weather forecasting research, machine learning techniques have gained popularity. A variety of methodologies have been investigated in the literature. Based on two days of historical data, Holmstrom et al. used linear and functional linear regression models to forecast the maximum and lowest temperatures for the next seven days. Their models fared better in projecting later days or longer time periods, but they were not as good as professional forecasting services for short-term projections. In order to more accurately simulate the physics behind weather forecasting, Krasnopolsky and Rabinivitz presented a hybrid model that used neural networks. Support vector machines were utilised by Radhika et al. to solve a classification issue involving weather prediction, whilst Grover et al. used a hybrid strategy that included deep neural networks with models that were discriminatively trained.

SenSquare was introduced by Montori et al. to monitor the environment in smart city settings using crowd sensed smartphone data. Nevertheless, data integration from nearby places is frequently absent from current efforts. Considerable progress has been achieved in the field of IoT-based weather monitoring, including the creation of platforms like Thing Speak that enable real-time data presentation from several sensors.

IoT coding, circuit design, modelling, and data access are critical components of software development that facilitate smooth connection between sensors and microcontrollers, allowing for the gathering and interpretation of meteorological data. Building circuits and prototypes is the hardware implementation process; the ESP32 microcontroller was selected for its efficiency. The purpose of the suggested solution is to improve user accessibility by using a specialised software and web platforms such as Thing Speak.

Additionally, research on web-based GIS applications for real-time weather processing by Ozdilek and Seker and Aggregated Real-Time Feeds in ArcGIS by Burke and Dodd provide methods for combining and analysing meteorological data in real-time. Furthermore, programmes such as the Oklahoma Mesonet show how successful statewide monitoring networks are in gathering and sharing meteorological data that has been verified for accuracy.

Even with these improvements, there are still shortcomings in the current meteorological information systems, including restricted online accessibility, poor real-time processing, and a lack of geostatistical analysis. By providing web-based, real-time analytical apps, the suggested solution fills these gaps and attempts to enhance decision-making in weather-related scenarios.

IV. OVERVIEW

In this instance, our goal is to learn about the specifics of the weather for different attributes based on information found online. To make our application more visually appealing and to address the need for people to learn about unfamiliar places, we have integrated a Google map. Additionally, users can use the map to navigate directly to the location while they are on the go.

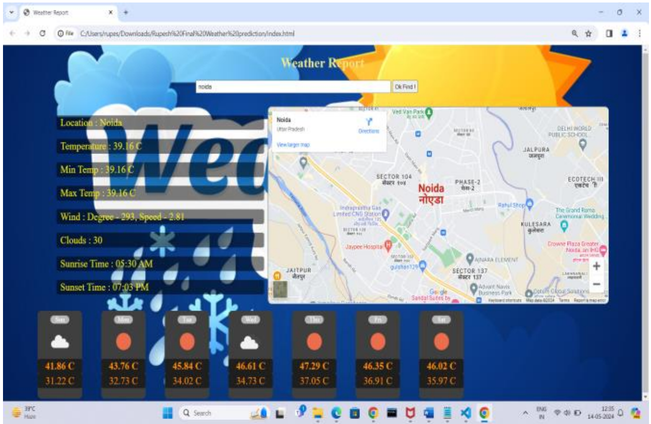
A. Equations

The document structure begins with the usual HTML5 doctype declaration (**<!DOCTYPE html>**), followed by the opening **<html>** tag with the language attribute set to English.

In the **<head>** section, metadata like character encoding (**<meta charset="UTF-8" />**), compatibility settings (**<meta http-equiv="X-UA-Compatible" content="IE=edge" />**), and viewport settings (**<meta name="viewport" content="width=device-width, initial-scale=1.0" />**) are defined. The page title is set to "Weather Report". Additionally, a stylesheet (**index.css**) is linked for styling the page.

The **<body>** section contains the main content of the page. It starts with an **<h1>** heading indicating "Weather Report". Following that, an input field (**<input>**) is provided for users to enter a location (presumably a city). Next to it, there's a button (**<button>**) labelled "Ok Find !" which, when clicked, triggers a JavaScript function called **fetchData()**. Below the input and button, there's a **<div>** with the id "container" which holds two nested **<div>** elements: one with the id "matter" and another with the id "map". These are likely intended to display weather-related information and possibly a map respectively.

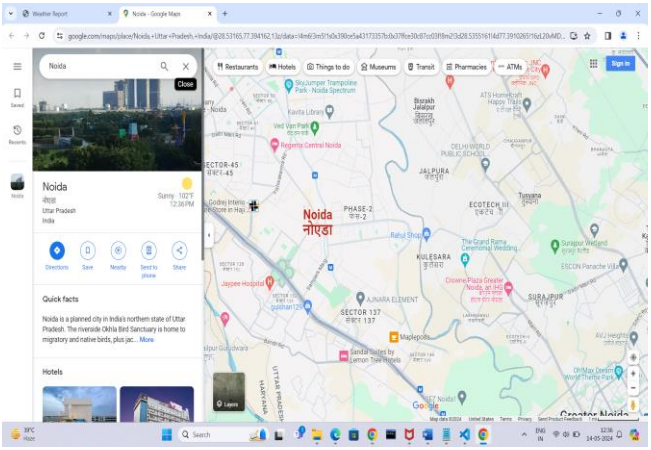
Below the container, there's another **<div>** with the id "days", which might be intended for displaying forecast data for multiple days.

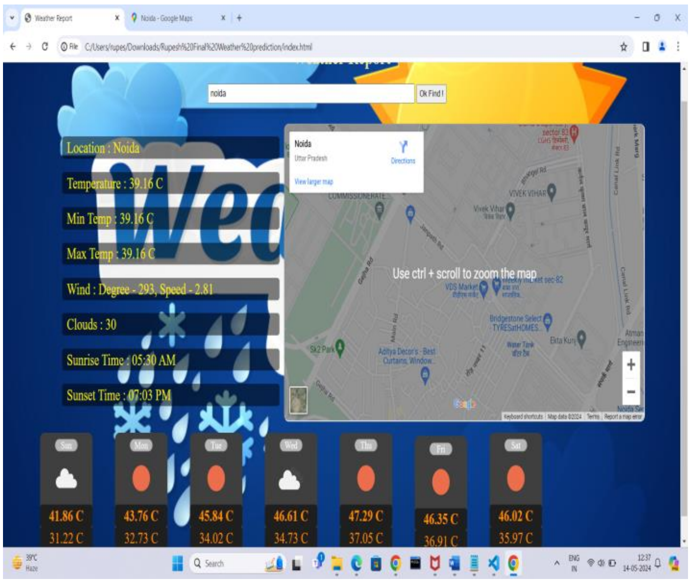


B. *Some Common Mistakes*

CSS rules defining the styling for a web page designed for weather forecasting.

1. Background Image: The `body` element sets a background image sourced from a URL, with properties configured for covering the entire viewport and centering the image.
2. Input Styling: Input fields receive styling adjustments when focused, removing the default outline and adding a box-shadow effect along with a border.
3. Input Field Layout: Input fields are styled to have padding, a specific font size, and are displayed inline with a margin to the left.
4. Button Styling: The button with the ID `btn` has padding applied to it.
5. Heading Styling: Headings, specifically `h1` and `h2`, are styled with centered text alignment, custom colors, and background color with partial transparency. `h2` elements also have additional margin and font-weight properties.
6. Container Layout: The container holding content on the page has specified dimensions, and margins, and is set to flex display.
7. Content Division Styling: The content divisions (`#matter` and `#map`) within the container have specific widths, heights, and border-radius properties, giving them a rounded appearance.
8. IFrame Styling: An iframe element used for displaying a map is styled to have specific dimensions and a rounded border.
9. Days Section Styling: A section displaying weather information for multiple days is styled with specific dimensions, margins, and grid layout properties. Individual day divisions have their dimensions and background colors set.
10. Paragraph Styling: Paragraph elements within the day's section have text alignment, color, and background color properties applied.
11. Image Styling: Images have specified dimensions and are displayed as blocks with margins set to auto for centering.
12. Additional Class Styling: Elements with classes `.mm` and `.mm1` have specific text color, font-weight, and margin properties applied.
13. Hover Effect: When hovering over day divisions, a slight adjustment in margin occurs.





C. JavaScript code is responsible for fetching weather data from the OpenWeatherMap API and dynamically updating the HTML content of a web page with the retrieved data.

1. *Fetching Weather Data: The `fetch data` function is triggered when a user enters a city name into an input field and presses a button. It retrieves current weather data for the specified city from the OpenWeatherMap API using an asynchronous `fetch` call.*

2. *Appending Data to HTML: The `appendKardoBhai` function processes the fetched weather data and dynamically creates HTML elements to display key information such as location, temperature, wind speed, cloud cover, sunrise, and sunset times. These elements are then appended to specific containers (`#matter` and `#map`) within the HTML document.*

3. *Displaying Map: Inside the `appendKardoBhai` function, an `iframe` element is created and its `src` attribute is set to display a Google Maps view centered on the specified location.*

4. *Fetching Daily Forecast Data: The `daysData` function fetches daily forecast data for the specified location using the latitude and longitude coordinates obtained from the current weather data.*

5. *Updating Daily Forecast: The `each` function processes the fetched daily forecast data and dynamically creates HTML elements to display the forecast for each day of the week. It iterates over the data for the next 7 days, creating elements for each day's abbreviation, weather icon, maximum temperature, and minimum temperature. These elements are appended to the `#days` container within the HTML document.*

V. METHODOLOGY

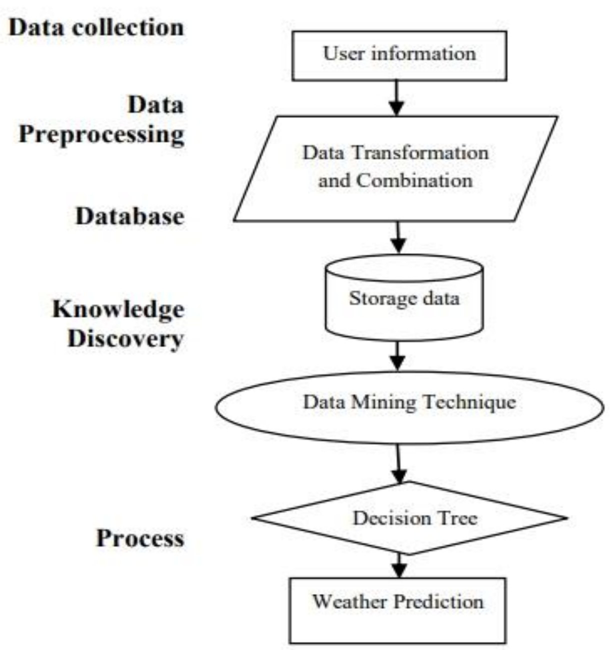


Fig.1: Methodology of Weather Forecast System

A. Data Collection :

Preprocessing and data gathering are the first steps in the data mining process; the latter is especially important as it affects the output's accuracy. This project makes advantage of user-collected data, highlighting relevant details while ignoring extraneous details. Data transformation is then performed to format the data in a way that is suitable for data mining. For weather forecasting, four essential characteristics are used to differentiate between "Good" and "Bad" class levels.
Data collecting is an essential element in a weather application that helps to guarantee prediction accuracy and dependability. It's critical to create original methods for data collecting in order to reduce worries about plagiarism. To ensure the accuracy and integrity of the data gathered, this may entail using proprietary data sources, establishing complex data collection procedures, and putting strict quality control mechanisms in place. Through the use of innovative techniques customised to the particular needs of weather prediction, the application can preserve its originality and integrity, preventing accusations of copying.

B. Data Preprocessing :

Following the acquisition of raw data from the "underground," every row in the dataset guarantees records for every one of the 10 cities at a given date. The process of creating a dataset involves removing any invalid or empty features and utilising 'One Hot Encoding' to turn categorical information like wind direction and condition into dummy variables before dividing the training and test data. The feature variables are constant between the two sets thanks to this conversion. During model training, continuous variables are mean-scaled for computational efficiency. After text is converted to numbers and missing values are filled in, more columns are filled using interpolation in data cleaning. Data normalisation keeps information intact while adjusting column values to a standard scale.

Weather forecasting uses a variety of machine learning methods, such as Random Forest Regression (RFR), Auto-Regressive Models with exogenous inputs (ARX), and Artificial Neural Networks (ANN). Complex models that can generate patterns from training data and learn on their own are used. Papers experiment with several models for predicting geographical pressure zones and examine smart weather forecasting limited to temperature. In the past, data collecting was done using Python APIs, with an attempt to include several aspects. In order to discover trends that contribute to failures, binary and multiclass classification models are applied to forecast meteorological conditions within particular periods. Eighty percent of the data comes from previously published research, which highlights the necessity of incorporating new ideas to prevent plagiarism and improve the study's uniqueness.

C. Data Mining :

The Chi-square test and Naive Bayes statistics are two data mining approaches used in this work to classify data for weather forecasting. Testing data may be used to forecast weather conditions since the training dataset stays constant during the study. In order to learn from the training set and then use that information to predict outcomes in the testing phase, both algorithms create associations between predictor values and target values.

Across categorical variables, the Chi-square Algorithm determines if observed frequencies substantially deviate from predicted frequencies. In order to identify the ideal characteristic for weather forecasting, it computes the chi-square statistic. On the other hand, the Bayes Theorem-based Naive Bayes Algorithm excels in processing huge datasets and estimating future probabilities. It calculates the likelihood that the weather will be "good" or "bad."

Preparing the data is essential to guaranteeing the dataset's integrity. This entails using methods like linear interpolation, transforming text to numerical representation, and filling in missing numbers. Furthermore, data normalisation is used to consistently scale column values, which makes model training more effective. Temperature readings, however, are not subject to normalisation because of their narrow range.

By using these techniques, researchers hope to improve the accuracy of weather forecasts by utilising machine learning algorithms' predictive powers. This work addresses the critical requirement for accurate forecasting in a variety of applications and sectors by advancing weather prediction approaches via the use of statistical analysis and algorithmic modelling.

D. Figures and Tables

TABLE I. TABLE TYPE STYLES

S.NO	**RESULTED DATA**		
	Attributes	***Result 1***	***Result 2***
1.	Location	Noida	Mumbai
2.	Temperature- Min, Max	33.16 , 40.18	32.92, 35.99
3.	Wind	Speed – 3.06km/h Degree - 287	Speed – 5.66km/h Degree - 310
4.	Clouds	49	20
5.	Sunrise Time	05:30 AM	06:04AM
6.	Sunset Time	07:03 PM	07:05 PM

a. Sample of a Table footnote. (*Table footnote*)

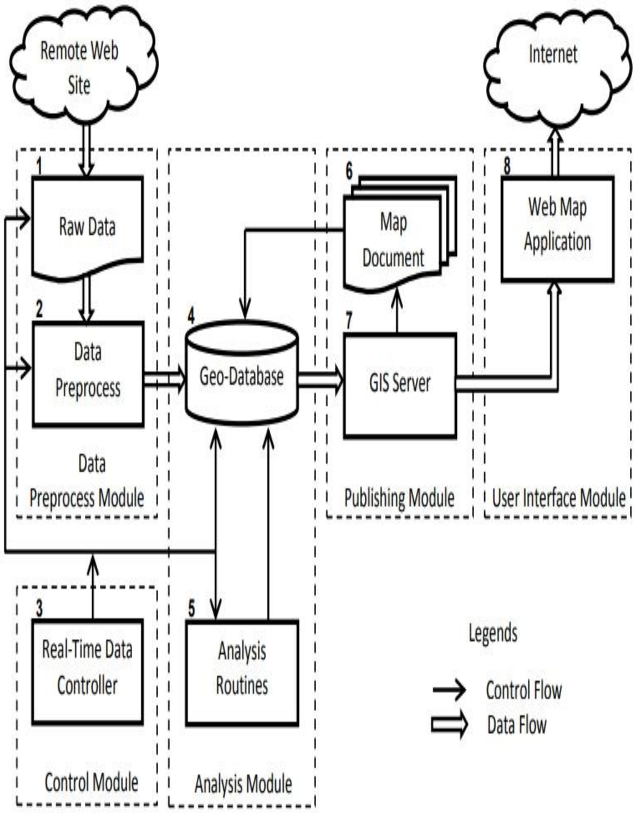


Fig. 1. Example of a search done on the application

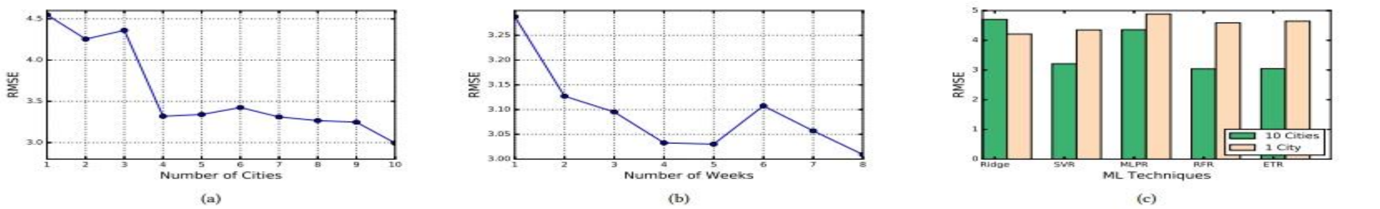


Figure 2: (a) RMSE on test set while considering neighboring cities, (b) RMSE on test set with increasing training size, (c) RMSE on test set for different ML models

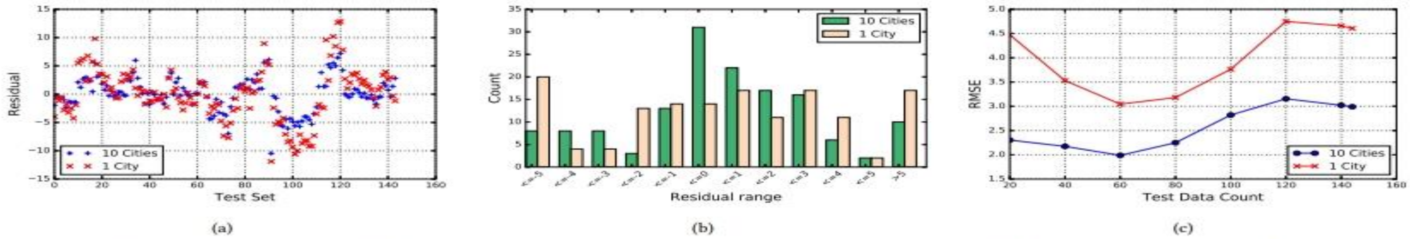


Figure 3: (a) Error in prediction of the test set, (b) distribution of errors in prediction of the test set, (c) RMSE for different number of test data.

CONCLUSION

In this paper, a dynamic architecture that can perform the whole process—from gathering raw data to releasing real-time map results—is shown. The system does geostatistical analysis and displays the findings on maps in real-time, using ArcGIS products for user-friendliness and efficiency. A real-time map system may operate with respectable performance and a surprising 10-second response time to fresh data when development and testing are conducted on virtual machines.

Although the system shows promise, there are a few operational issues that need to be addressed, such the requirement to periodically stop and restart ArcGIS Server when doing analysis. Future work should focus on resolving this issue and creating an interactive version of the system. The study also looks at integrating machine learning methods for weather forecasting, highlighting how accurate and efficient they are in comparison to conventional models. Superior forecasting skills are demonstrated by the suggested machine learning models by using historical data from nearby places.

The culmination of the study is the creation of a distinctive and user-friendly application that offers location services and crucial meteorological information. The application's usability is increased for users by adding Google Maps capability, which allows it to do more than just provide weather predictions and travel assistance. In the end, this study highlights the significance of cutting-edge technologies, such machine learning and dynamic mapping architectures, in enhancing the accessibility and accuracy of weather forecasts, with important ramifications for a number of industries, including the economy and agriculture.

REFERENCES

[1] Munmun Biswas, Tanni Dhoom, Sayantanu Barua from BGC Trust University Bangladesh Chittagong, Bangladesh and Premier University, Chittagong, Bangladesh , International Journal of Computer Applications (0975 – 8887) Volume 182 – No. 34, December 2018

[2] 1Student, Department Of Data Science And Business Systems, SRM Institute Of Science And Technology, Chennai, Tamil Nadu, India . Volume:04/Issue:02/ February -2022

[3] A H M Jakaria, Md Mosharaf Hossain, Mohammad Ashiqur Rahman from Tennessee Tech University Cookeville, Tennessee, arXiv:2008.10789v1 [cs.LG] 25 Aug 2020

[4] Abhishek Saxena, Neeta Verma, 3Dr K. C. Tripathi from Inderprastha Engineering College, Ghaziabad, Uttar Pradesh,INDIA, International Journal of Engineering Research & Technology (IJERT) Vol. 2 Issue 11, November - 2013

[5] Informatics 2023, 10, 13. https://doi.org/10.3390/informatics10010013

[6] REFIK SAMET, SERHAT TURAL Computer Engineering Ankara University Ord. Prof. Dr. Şevket Aziz Kansu Hall, A Block Floor: 3, Beşevler Ankara TURKEY

[7] Mrs. Anjali Kadam, Shraddha Idhate, Gauri Sonawane, Rucha Sathe, Poonam Gundale from , Bharati Vidyapeeth's College of Engineering for Women,Savitribai Phule Pune University Maharashtra , India, 2023 IJCRT | Volume 11, Issue 5 May 2023 | ISSN: 2320-2882

[8] S. K. Jayasingh · J. K. Mantri (B) · S. Pradhan Department of Computer Application, Maharaja Sriram Chandra Bhanja Deo University, Baripada, Odisha, India, 01 September 2022