A

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Weather Application

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by

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A. P. SHAH INSTITUTE OF TECHNOLOGY

CERTIFICATE

This is to certify that the project entitled "**Weather Application**" is a bonafide work of Anish Gawade (22106109), Tanveer Angane (22106057), Krishna Dongre (22106057) , Siddharth Chaurasiya (22106060) submitted to the University of Mumbai in partial fulfillment of the requirement for the award of **Bachelor of Engineering** in **Computer Science & Engineering (Artificial Intelligence & Machine Learning).**

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Project Report Approval

This Mini project report entitled "**Weather web application**" by Anish Gawade, Tanveer Angane, Krishna Dongre and Siddharth Chaurasiya **is approved for the degree of Bachelor of Engineering in Computer Science &Engineering, (AIML) 2023-24.**

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Place: APSIT, Thane
Date: 15-09-2023

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ABSTRACT

Weather forecasting is very important in our daily life .It helps us to plan our day and prepare for disasters, and understand climate changes.

Advanced meteorological models, data collection technologies, and the proliferation of weather forecast applications have enabled precision forecasting, offering locationspecific insights into temperature, precipitation, wind patterns, and more.

This web application, often accessible across various browers, not only enhance daily decision-making but also contribute to the safety and well-being of individuals and communities by issuing timely weather alerts.

Additionally, historical weather data and interactive maps aid researchers, agriculturists, and climate enthusiasts in analyzing past weather patterns and understanding meteorological phenomena.

Weather forecasting applications stand as vital tools, equipping users with the knowledge to plan, adapt, and thrive in an increasingly dynamic climate landscape.

Keywords: Real-time Weather data , Location-Based Forecasting , Weather Alerts.

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CHAPTER 1

INTRODUCTION

1. INTRODUCTION

This project is about making weather application that makes it easier for people to get the latest and most accurate weather information.

The web application, aims to provide a seamless experience for users to check weather conditions, forecasts, and related data for any location worldwide .

This application will be available on multiple web browsers, ensuring accessibility for a wide range of users.

The motivation behind the project stems from the growing demand for accurate and accessible weather information in today's fast-paced and weather-dependent society.

Weather impacts daily routines, travel plans, outdoor activities, and even business operations. Users expect not only reliable data but also an engaging and user-friendly experience when checking the weather.

Moreover, the increasing frequency and severity of extreme weather events highlight the importance of readily available weather information for safety and preparedness.

Web application aims to address these needs and motivations by offering a weather application that combines the latest technological advancements with user-centric design principles to make weather information more accessible and user-friendly.

The primary objectives of the project are as follows:

1. Accurate Weather Data: To provide users with reliable and precise weather data sourced from reputable meteorological organizations and data providers.
2. User-Friendly Interface: To create an intuitive and visually appealing user interface that allows users to easily access and interpret weather information.
3. Personalization: To implement features that enable users to customize their weather experience by saving favorite locations, setting weather alerts, and receiving tailored forecasts.
4. Multi-Platform Support: To develop for multiple platforms (web), ensuring accessibility to users across various devices.
5. Real-time Updates: To deliver real-time weather updates and notifications to users to keep them informed about changing weather conditions.

The scope of the project encompasses several key aspects:

1. Weather Data Integration: Integration with reputable weather data providers to retrieve accurate and timely weather information.
2. User Registration and Profiles: A user registration system allowing users to create profiles, save preferences, and receive personalized weather updates.
3. Location-Based Services: The ability to obtain weather information for any location globally, including current conditions, hourly and daily forecasts, and historical data.
4. Notification System: A notification system that alerts users to significant weather events, such as severe weather warnings or changes in weather patterns for saved locations.
5. Cross-Platform Compatibility: Development of native website application, as well as a responsive web application accessible through various web browsers.

This report is structured to provide a comprehensive understanding of the project. Following this introduction, the subsequent sections will delve into the project's background, including a review of relevant literature and a survey of existing weather applications. We will also explore the historical context of weather forecasting and how it has evolved to the digital age. Subsequent sections will detail the project's development process, technology stack, challenges faced, and the final product.

CHAPTER 2

LITERATURE SURVEY

2. LITERATURE SURVEY

2.1-BACKGROUND

Weather forecasting traces its origins to ancient civilizations like the Babylonians and Greeks, who observed natural phenomena for predicting weather. In the 19th century, the invention of the telegraph enabled the transmission of weather observations over long distances, laying the foundation for more systematic weather forecasting. The establishment of national weather bureaus, such as the United States Weather Bureau (now NOAA), marked a significant step in organized weather prediction. Telegraphs were used to share weather data between stations and central offices, improving forecasting accuracy. Meteorologists like Sir Francis Galton and Lewis Fry Richardson pioneered the creation of weather maps, which allowed for the visualization of weather patterns. This led to more accurate weather predictions. The invention of radiosondes, devices attached to weather balloons to measure atmospheric variables like temperature and humidity, greatly enhanced upper-air data collection and forecasting accuracy.

During World War II, advances in computing and radar technology were applied to weather forecasting. The first numerical weather prediction models were developed, laying the groundwork for modern weather modeling. The launch of weather satellites in the 1950s and 1960s revolutionized weather forecasting by providing real-time data on global weather patterns. TIROS-1, the first weather satellite, was launched by NASA in 1960.Advances in computer technology and the development of numerical weather prediction models, such as the General Circulation Models (GCMs), led to more accurate and sophisticated weather forecasts. The 1990s saw the emergence of consumer-oriented weather services, including cable TV weather channels (e.g., The Weather Channel) and early weather websites offering weather forecasts and radar imagery. The proliferation of smartphones and mobile apps in the 2000s gave rise to a new era in weather forecasting.

Popular weather apps like Weather.com and AccuWeather made weather information readily accessible to users on the go. Weather applications in the 2010s began incorporating GPS technology, allowing users to receive hyper-local weather forecasts based on their exact locations. Social weather networks like Weather Underground and the integration of user-generated data allowed for crowdsourced weather reporting, enhancing the accuracy and coverage of weather information. Recent advancements in artificial intelligence and machine learning have enabled weather models to become more data-driven and accurate, improving forecast precision for short-term and long-term predictions. Weather applications are increasingly providing information on climate change, including historical climate data, climate modeling, and the impact of climate change on weather patterns.

These milestones highlight the journey from ancient weather observations to the sophisticated, data driven weather applications available today, with each era contributing to improved accuracy and accessibility of weather forecasts.

2.2-LITERATURE REVIEW

Review Paper On Weather Forecasting App

The active and break periods of the Saudi Arabian monsoon, including description parameters and processes, have been extensively cited and are utilized by academics in their research [6]. Using modern datasets gathered from satellites, researchers investigate the three-dimensional cloud patterns and the instability of such structures over the monsoon region and study space-radiation interactions and weather radiative pressure over the monsoon zone using many satellite datasets, as well as observing cloud radiation input throughout the Asian Monsoon region [7]. Multivariate information helps depict a wide variety of models and processes**.**

REFERENCE : An international open access portal

An Intelligent Early Flood Forecasting and Prediction Leveraging Machine and Deep Learning Algorithms with Advanced Alert System

Holmstrom et al. proposed linear regression and functional regression which forecasts weather by searching historical weather patterns which are most similar to current weather pattern and Rasel et al. performed a comparative study between Support Vector Regression and Artificial Neural Networks for temperature and rainfall prediction. The studies on deep learning neural networks , deep belief networks ,provide promising results with its "deep" architecture and higher learning ability in comparison to "shallow" machine learning models . In the last decade, Recurrent Neural Networks (RNNs) have gained widespread attention and developed rapidly due to their powerful and effective modeling capabilities

REFERENCE: MDPI OPEN ACCESS

Weather Prediction for Tourism Application using Time Series Algorithm

In [6] a complete weather forecasting system using WSN's and Arduino Uno has been discussed with predictive models but it has the same problem of energy and power degradation because of the having data load on WSN node. Many Machine learning and deep learning based predictive algorithms has been addressed in [7], [8] and [9] for weather forecasting, but all these algorithms require prior knowledge of sensed data to be predicted which is very difficult to maintain. There are a lot of adaptive prediction algorithms present, the choice of algorithm for the system with greater accuracy is totally dependent upon the convergence rate, accuracy rate and hardware complexity level..

REFERENCE : IJITEE.ORG

Prediction Based Data Reduction and Controlled Transmission in Wireless Sensor Network for Weather Forecasting

... Deep learning (DL) has made explosive progress in the field of computer vision (CV) (Krizhevsky et al., 2012). A number of good neural network architectures have been proposed (Szegedy et al., 2015;He et al., 2016) and promoted their practical applications in many fields, such as medicine (Wang et al., 2019), meteorology (Salman et al., 2015), and remote sensing (Zhu et al., 2017). Compared to traditional model-driven approaches, the main advantage of DL-based information processing is that the learning, extraction, and prediction of features are all included in an end-to-end network that avoids tedious manual designs and minimizes human errors by learning from a large number of samples.

REFERENCE : RESEARCH GATE

Rice-irrigation automation using a fuzzy controller and weather forecast

This paper presents a new irrigation controller based on fuzzy logic that uses weather forecast data and crop characteristics to evaluate the real-time need for irrigation of rice crops and to increase the efficiency of irrigation systems. Tests were performed with real data obtained from three different crop fields in Rio Grande do Sul State, Brazil, and on four meteorologically different days of the 2021/2022 harvest to demonstrate the ability to reduce power consumption for irrigation; the power consumption on days of heavy precipitation was above 80% under all simulated conditions. Depending on the size of the crop and the tested meteorological conditions, the minimum reductions in energy consumption were between 33-66% on dry days with no precipitation forecast. More than 15% reduction in the flow of the water catchment was also observed, even in the most adverse farming scenarios. This study reveals the necessity for technological advances in rice-crop irrigation systems to increase the efficiency of flood irrigation in large areas for reducing electricity consumption, increasing the profitability of rural producers, and ensuring the preservation and availability of water resources. Key words: irrigation control; energy efficiency; irrigated rice; fuzzy logic; surface irrigation

REFERENCE : SCIENCE DIRECT

Integrating Local Farmers Knowledge Systems in Rainfall Prediction and Available Weather Forecasts to Mitigate Climate Variability: Perspectives from Western Kenya

This chapter examines relevant studies and examples on integrating farmer's traditional knowledge systems in rainfall prediction with available weather forecasts to mitigate impact of changing climate among rainfall dependent farmers in Western Kenya. The chapter combines the results of a study conducted in Western Kenya among maize and wheat growing farmers in Uasin Gishu County and perspectives from other related studies within the Eastern and Southern part of Africa. The chapter details how farmers have navigated the impact of changing climate on the farming enterprise that is largely dependent on rainfall. The findings reveal that farmers in western Kenya have experienced crop losses during planting and harvesting seasons due to prevailing variations in weather patterns. This is corroborated by over 340 (87.8%) of farmers in Uasin Gishu county of Kenya who agreed so and further stated that they had experienced changes in rainfall patterns and even the timing for maize and wheat growing had become uncertain and contrary to what they have known over time in the recent years. Similarly, like other findings in the reviewed studies in this chapter, the Kenyan farmers (84.9%) agreed strongly that they applied their local indigenous knowledge and experience gained over time to predict rainfall onset and cessation dates thus making key farming decisions. Relying heavily on traditional weather forecasting by farmers is catastrophic now due to changes on the environment associated to environmental degradation; ecosystem disturbance and changing climate which have seen important traditional predictor indicators disappear or lost completely from the environment. Although over 90% of the Kenyan farmers in average belief in use of weather forecast information, integration of this information is not effective because of its adaptability, format and timing challenges. The same is true for farmers in some countries within the region. Importantly, provision of context-specific and downscaled weather forecast information to support farmer's resilience is crucial. Most studies and programmers reviewed in this chapter agree that there is synergy in integrating local knowledge systems and available weather forecast information for better weather prediction. It is critical that policymakers, practitioners or key stakeholders and forecasters (both from the meteorological services and indigenous groups) converge and agree on weather prediction if they are to support farmers in managing climate risk or uncertainties.

REFERENCE : INTECHOPEN

The usefulness of medium range weather forecast in improving the quality of output from CROPGRO-Soybean model

CROPGRO-Soybean model calibrated for local conditions of Raipur has been used to evaluate the relevance of medium range weather forecast relative to the soybean crop growth period. A procedure that makes use of historical weather data, medium range weather forecast (mrwf) and current weather data in conjunction with the CROPGRO-Soybean model was developed to arrive at a probable distribution of predicted yield. A series of perfect mrwf for 5 days were assumed for assessing the sensitivity of the crop management system to forecast information. The relative importance by time of year was taken as a reduction in variance due to a perfect 5-day mrwf. The results of the study, conducted for two reference years 1986 (low-production year) and 1993 (high-production year) at Raipur, showed that the yield estimation can be done 20 days in advance before the physiological maturity for low-production year (1986) and 15 days in advance before physiological maturity for high-production year (1993). For both the years mrwf during reproductive phases are more valuable. It has also been concluded that the longer forecast periods are responding earlier in the growing season with higher values too.

REFERENCE : indian meterological department

Sr.No.	Title	Method	Limitation
1.	Review Paper On Weather Forecasting App	3-D cloud pattern	Require high resolution, significant computational resources
2.	An Intelligent Early Flood Forecasting and Prediction Leveraging Machine and Deep Learning Algorithms with Advanced Alert System	Historical weather pattern	Do not incorporate real-time data, such as current atmosphere condition.
3.	Weather Prediction for Tourism Application using Time Series Algorithm	Time series algorithm	Require prior knowledge of sensed data
4.	Rice-irrigation automation using a fuzzy controller and weather fore	Fuzzy logic (Weather forecast data & crop characterstics	Used for short term weather forecast and less sutiable for long term weather forecast
5.	Integrating Local Farmers Knowledge Systems in Rainfall Prediction	Farmers traditional knowledge system	Depends on farmers experience and accuracy
6.	The usefulness of medium range weather forecast	Medium range weather forecast	Limited range forecast

CHAPTER 3

Problem Statement

3. Problem Statement

In an era characterized by increasing climate variability and the growing impact of weather conditions on daily life, the development of a robust and versatile weather forecast application has emerged as a necessity. This application navigates a complex landscape of challenges to effectively meet the diverse needs and expectations of users. It must excel in aggregating and processing meteorological data from a multitude of sources, including satellites, weather stations, and advanced modeling, to provide users with exceptionally accurate and up-to-theminute weather forecasts encompassing current conditions, short-term outlooks, and longrange predictions. The user experience is paramount, demanding a user centered design that prioritizes intuitiveness, accessibility, and ensuring that individuals of varying technological proficiency can interact seamlessly with the app. Users must be empowered to personalize their weather experience, from choosing preferred units (e.g., Celsius or Fahrenheit) to language settings and notifications tailored to their unique requirements. An essential component is alert system capable of delivering timely and comprehensible warnings for severe weather events, including storms, hurricanes, tornadoes, or extreme temperature fluctuations, ultimately prioritizing user safety. The application should seamlessly integrate geolocation services, automatically detecting and presenting weather information for the user's current location while allowing for location-specific searches or the convenient saving of multiple locations. Data visualization techniques, such as interactive maps, charts, and graphs, must be employed to present weather information in an engaging and informative manner, fostering user comprehension. Reliability and uptime are paramount, requiring a robust infrastructure that minimizes downtime and service interruptions, particularly during critical weather events. Cross-platform compatibility is a must, ensuring accessibility via web browsers, mobile devices (both iOS and Android), and emerging technologies. Sustainability considerations should also be factored in the overarching mission is to create a weather forecast application that exceeds user expectations, equipping individuals with the tools they need to make informed decisions about daily activities and safety while enhancing their overall weather-related experiences.