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AN EFFECTIVE WEATHER FORECASTING USING MICROCONT-ROLLER

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ABSTRACT :

Despite limitations for true forecasting, ATmega microcontrollers can be the heart of an effective weather monitoring system. By interfacing with sensors and potentially transmitting data, they create a scalable data collection network. This feeds valuable local weather information to powerful servers for advanced forecasting, improving accuracy and leveraging the strengths of both microcontroller and server-side processing.

Introduction :

Weather forecasting is a crucial field impacting agriculture, disaster preparedness, and everyday life. While complex models run on powerful computers provide long-term forecasts, there's a growing need for localized, real-time data. This is where the ATmega microcontroller steps in. Though not powerful enough for standalone weather forecasting, the ATmega's ability to interface with sensors and its affordability make it ideal for building a robust weather monitoring system. This system can collect real-time data on temperature, humidity, pressure, and wind speed, paving the way for a more comprehensive understanding of local weather patterns. Users can interact with the system through a simple interface, such as sending commands via SMS to request weather updates for specific locations or time frames. The system responds accordingly, providing tailored forecasts to users

II. LITERATURE REVIEW :

MACHINE LEARNING BASESD SMART WEATHER PREDICTION

The prediction of atmospheric conditions based on a specific time and location is known as weather forecasting. Weather forecasting is crucial and affects a wide range of industries, including maritime transportation, aviation, energy and utilities, agriculture, and forestry to a larger degree. Farmers can better manage their farming operations and avoid crop losses by using accurate weather forecasting systems. This work used machine learning algorithms like linear regression, support-vector machine (SVM), and decision trees, along with conventional temperature-based empirical models to predict the weather parameters, which include precipitation, relative humidity, wind speed, and solar radiation, for a few locations in India. Weather parameter forecasting, which is essential to agriculture, improves planning for farmers and other agriculturally oriented enterprises and raises total yield. With a mean square error of 0.1397 and a correlation value of 0.9259, the current results show that machine learning (ML) based approaches outperformed conventional physics-based models in weather forecasting. The goal of this work is to use machine learning models to produce better weather predictions with less computing work and an optimised final output.

INTERNET OF THINGS BASED WEATHER FORCASTING

One of the most consistently difficult problems in meteorology worldwide is weather forecasting, which plays a crucial role in the field.This plan outlines the construction of a weather display system using inexpensive parts that anyone with an interest in electronics may assemble. Rather than relying on sensors to gather weather data, the development uses a worldwide weather data source to obtain information from weather stations located all over the world. Severe weather events present a challenge to the complex weather forecasting methodology with its incomplete explanation. There are too many parameters for weather occurrences to be detailed and calculated. As communication methods advance, specialised weather prediction systems are able to pool and exchange resources, leading to the emergence of hybrid systems. Even with these advancements in climate prediction, these expert systems cannot be completely trusted in the absence of weather forecasting.

WEATHER PREDICTION USING RANDOM FOREST MACHINE LEARNING MODEL

Scientists find it extremely difficult to anticipate weather patterns due to the intricate numerical climate models, particularly for tropical systems. The main goal of this work is to demonstrate the value of weather prediction through machine learning (ML) techniques. It has been shown recently by numerous academics that machine learning algorithms, even those lacking accurate knowledge of atmospheric physics, are capable of producing reasonable weather predictions. In this work, a random forest machine learning model is used to forecast wind speed in metres per second and global solar radiation (GSR) in MJ/m2/day for Tamil Nadu, India. Data on sun radiation and wind measurements obtained from IMD, Pune, are used to validate the random forest machine learning model. The SVM ML model and statistical regression models are contrasted with the prediction results derived from the random forest ML model. The method described in this research uses a passive infrared sensor to detect motion and determine the progress of the human subject. The random forest machine learning model has an R2 score of 0.97 and a minimum error value of 0.750 MSE overall. The prediction outcomes of the random forest machine learning model are more accurate than those of regression models and SVM ML models. Consequently, this study disregards the requirement for a costly measuring device at each possible position in order to obtain the data on solar radiation and wind speed.Weather forecasts are crucial for the safe and effective operation of the electrical system. The two most common renewable energy sources are solar and wind power since they are easily accessible and abundant in many regions of the world. Precise comprehension of solar and wind data is crucial for applications that depend on renewable energy. Due to high costs and challenges with measurement methods, solar and wind data is not available everywhere in the world. Due to data scarcity, forecasting solar radiation and wind speed is crucial for the efficient and correct use of these renewable energy sources. This study focuses on obtaining data on wind speed and sun radiation without the need for costly monitoring equipment.

SHORT TERM WEATHER FORCASTING USING SPATIAL FEATURE ATTENTION BASED LSTM MODEL

Meteorological analysis and weather prediction play a major role in sustainable development by mitigating the damage caused by extreme events that could otherwise regress development efforts for years. One of the key markers for identifying climate change is variations in the surface temperature. In order to accurately capture the spatial and temporal interactions of many meteorological features and forecast temperature, we present a unique deep learning model in this study called the Spatial Feature Attention Long Short-Term Memory (SFA-LSTM) model. sources of energy resources. It describes the advantages of using the most economical and efficient method of cleaning.

W-MAE: PRE-TRAINED WEATHER MODEL WITH MASKED AUTOENCODER FOR MULTI-VARIABLE WEATHER FORE-CASTING

A long-standing computational problem with immediate social and economic effects is weather forecasting. This task is ideal for deep learning models since it requires a lot of continuous data gathering and shows rich spatiotemporal dependencies over extended periods of time. In this study, we present W-MAE, a Weather model with Masked AutoEn-coder pre-training for weather forecasting, and apply pre-training approaches to weather fore-casting.In order to reconstruct spatial correlations within meteorological variables, W-MAE is pre-trained in an autonomous manner. In order to represent the temporal dependencies found in weather data, we fine-tune the pre-trained W-MAE to predict the future states of meteorological variables on a temporal scale.Using data from the Fifth Generation ECMWF Reanalysis (ERA5), we perform our tests, selecting samples every six hours.Based on experimental findings, our W-MAE framework provides three main advantages: 1) The use of our pre-trained W-MAE can effectively mitigate the issue of cumulative errors in prediction when forecasting the future state of meteorological variables, ensuring stable performance in the short-to-medium term.

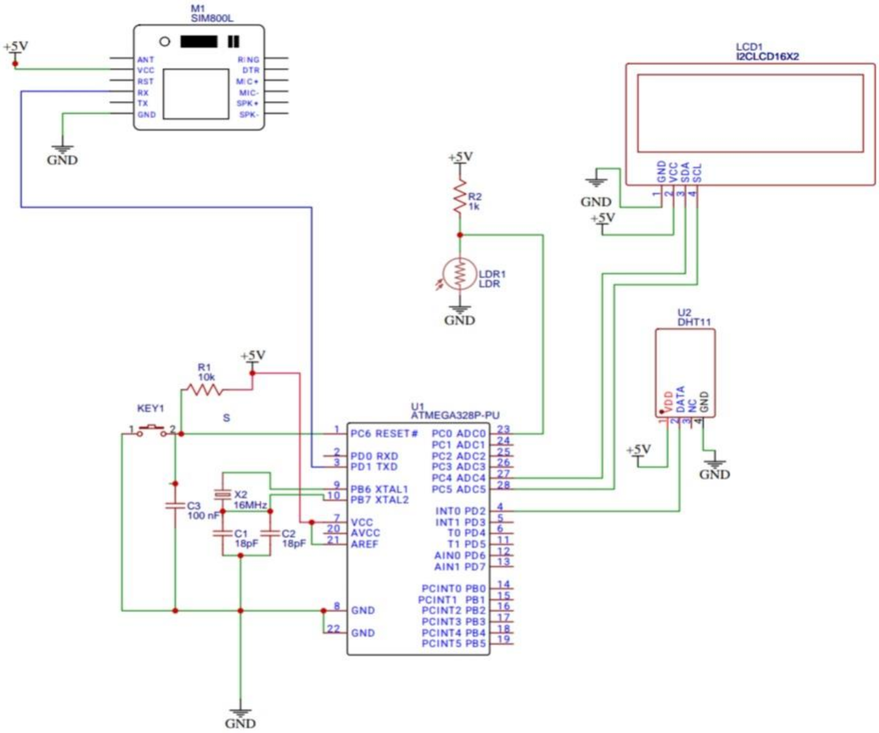
III . METHODOLOGY :

The aim of weather forecasting using GSM (Global System for Mobile Communications) with an ATmega microcontroller involves leveraging the capabilities of both technologies to provide real-time weather updates and alerts to users via SMS messages. Here are the methodologies involved .Utilize sensors to collect weather data such as temperature, humidity, and pressure..Interface these sensors with the ATmega microcontroller to read the data.Implement algorithms on the microcontroller to process the collected weather data. Based on the forecasted weather conditions, send SMS alerts to designated recipients.Include relevant information such as current weather readings, forecasted conditions, and any potential weather-related risks.By combining the capabilities of GSM communication and ATmega microcontroller-based processing, this project aims to deliver timely and actionable weather forecasts to users, enabling them to make informed decisions and mitigate weather-related risks

KEY COMPONENETS

1.ATMEGA 328 MICROCONTROLLER
2.DHT11 SENSOR
3.SIM800 GSM MODULE
4.16 X 2 LCD DISPLAY
5.POWER SUPPLY
6.USER INTERDACE
7.CONNECTING WIRES

CIRCUIT DIAGRAM



WORKING :

The first step is to gather data from various sources. This includes meteorological stations, satellites, weather balloons, and ground sensors. These sources provide information such as temperature, humidity, air pressure, ..Once the data is collected, it needs to be transmitted to a central processing unit. In this case, GSM technology is used for data transmission. The Atmega microcontroller is equipped with a GSM module that enables communication with a central server .The collected data is sent over the GSM network to the server. Upon receiving the data, the central processing unit begins to analyze it. Interpret the raw data and generate forecasts. These models take into account factors such as atmospheric dynamics,and geographical features. Based on the processed data, weather forecasts are generated. These forecasts typically include predictions for temperature, and atmospheric conditions over a specified period, ranging from hours to days ahead. The generated forecasts are then disseminated to end-users through various channels. This can include mobile applications, and automated phone messages. Users can access the forecasts in real-time to plan their activities accordingly

IV. WORKING MODEL :

V. CONCLUSION :

In conclusion,leveraging the capabilities of the ATmega microcontroller presents a promising avenue for the development of an efficient weather prediction system. By integrating sensor data collection, and cost-effective solution offers reliable weather monitoring and forecasting capabilities.Through optimization for low power consumption and robustness, coupled with user-friendly interfaces and scalability, the system can cater to a diverse range of applications. Ultimately, such a system empowers individuals, businesses, and organizations with timely and accurate weather insights, facilitating informed decision- making and enhancing resilience in the face of changing.

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VI . REFERENCE :

[1]Ashenafi Lambebo, Sasan Haghani, 2014, A Wireless Sensor Network for Environmental Monitoring of Greenhouse Gases, ASEE 2014 Zone I Conference,University of Bridgeport, Bridgpeort, CT, USA.

[2] D. S. Arjun, A. Bala, V. Dwarakanath, K. S. Sampada, B. B. Prahlada Rao and H. Pasupuleti , 2015, Integrating cloud-WSN to analyze weather data and notify SaaS user alerts during weather disasters, IEEE International Advance Computing Conference (IACC), pp. 899-904.

[3] Srinivasa K.G. M.S.Ramaiah. Siddiqui.N. Kumar. A, ParaSense - A Sensor Integrated Cloud Based Internet of Things Prototype for Real Time Monitoring Applications, in region10 IEEE Symposium (TENSYMP), 2015,

[4] S.P.KALSI, 2008, Satellite Based Weather ForecastingI…