WEATHER FORECASTING WITH AUGMENTED REALITY

A Synopsis Submitted to

Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal
Towards Partial Fulfillment for the Award of

Bachelor of Technology
(Computer Science and Engineering)

Under the Supervision of
Professor Preeti Shukla

Submitted By
Aryan Tapkire
(0827CS201044)
Devesh Sharma
(0827CS201068)

Department of Computer Science and Engineering
Acropolis Institute of Technology & Research, Indore
July-Dec 2022

Abstract

Weather forecasting is the attempt by meteorologists to predict the weather conditions at some future time and the weather conditions that may be expected. The climatic condition parameters are based on the temperature, wind, humidity, rainfall and size of data set. The data is collected from the temperature and humidity sensor called DHT11 sensor, which helps in detecting the temperature and humidity values of a particular region or location. Augmented reality (AR) is the integration of digital information with the user's environment in real time. Augmented reality is used to either visually change natural environments in some way or to provide additional information to users. The primary benefit of AR is that it manages to blend digital and three-dimensional (3D) components with an individual's perception of the real world. Our project is about integrating weather forecasting API with augmented reality to present the user with 3d graphics, which helps them learn about their local city weather conditions in a better and effective way.

Introduction of the Project

Weather Forecasting
Weather is the condition of air on Earth. It is a continuous, data-intensive, multidimensional, dynamic, and chaotic process. These properties make weather forecasting a formidable challenge. Forecasting is the process of estimation in unknown situations from the historical data.
Augmented Reality
Augmented reality (AR) is the real-time use of information in the form of text, graphics, audio, and other virtual enhancements integrated with real-world objects. It is this "real world" element that differentiates AR from virtual reality. AR integrates and adds value to the user's interaction with the real world, versus a simulation.

Objective

Our primary objective is to make an application: -

- Which is portable, flexible, and efficient at foretelling weather conditions.
- Which portrays 3d models to help user easily visualize weather conditions.
- Which is reliable in displaying weather conditions.
- Which is correct and maintainable for future updates.

Scope

The scope of this project, is to extend the visualization and analyzation of weather reports using augmented reality, and not to limit the end-user with just temperature sensing but also providing user with knowledge of other factors like pressure, humidity, wind flow, timing of sunrise and sunset.

Study of Existing System

Available System	Strength	Weakness
Barometer	Cost efficient, helps to predict sudden changes	Only for short term weather changes
Looking at the sky	No cost, Faster, Easier	Highly inaccurate
Nowcasting	Help predict storms, Provide location-specific forecasts	Accurate warning requires human involvement
Ensemble Forecasting	Predicts forecasts of days ahead	May give uncertain predictions of later days
Radar	More accurate results, Locates precipitation, Flood forecasting, Hail detection, High quality data	Cannot detect fog, cannot detect winds, requires expertise to analyse
Weather Satellite	Ability to monitor ocean currents, their temperature and composition, Provides valuable insights into oceanic temperature patterns across the globe, Beneficial for long-range forecasts	Very expensive, requires scientists to study and analyse data from satellites

Project Description

In our project, the method of creating a weather forecasting app is quite simple. First, user is requested to give three permission of its device namely: camera, location and internet. The user is then required to type the name in search box, of the place for which the weather report is required. The user is displayed with required data about the searched location. The user is also able to navigate to another page for viewing the AR models to check weather report.

Methodology

- Firstly, we use Android Studio IDE to start making our project with Kotlin as the language, we had also use JSON file to integrate API to our project and then XML is used to create user interface for making the app interactive.
- To start with the project, we first got done with permissions from the user, i.e., to enable internet, location and camera permission in order for the app to become functional.
- In order to get all the three permissions from user, we create an androidmanifest.xml file where we enable all these services to start getting data from user.
- Second thing we did is to get the data extracted from OpenWeather API using JSON.
- Then the JSON data extracted from the API is stored into Kotlin class.
- The JSON data stored in the Kotlin class is invoked using getter and setter function.
- Third step we performed is to integrate the android library 'Volley.'
- Volley library is called in the build.gradle file.

- Current weather data from OpenWeather API is displayed using volley library.
- Using the Google Scene Form library, AR Core package is selected for the purpose of displaying 3d graphics on user's screen.
- In build.gradle file google AR Core package is installed.
- This package helps in rendering 3d graphics on user's screen in real time.
- Further, user's camera is used to provide the 3d interactivity for better visualization and analysis of weather report.

Expected Outcome

Resources

Developer's Requirement: -
Hardware:

- A computer with Android Studio
- Must be optimized for running Kotlin and XML

Software:

- Permission for user location
- Permission to use camera for augmented reality features
- Permission to use internet

User's Requirement: -
Hardware:

- An android phone
- An internet connection

Software:

- Android version 5.0 (Lollipop)

Limitations

- Requires an internet connection
- Users need to enter city names as local area weather is not available
- Smaller cities or towns data is unavailable
- Lag time may increase due to augmented reality feature

Conclusion

Weather plays a major role in our daily life, and without the meteorologist and forecaster we would have difficulty planning our daily activities. As we can see, the weather is not a simple subject like we may have been thinking. The study of weather phenomenon requires the use of science, math, and different types of equipment and technology and data. Even with all these equipment, data, and observation tools, the weather continues to be a topic to study because it is constantly changing. Meteorologist and forecasters predict the weather and its possible changes, but weather is still unpredictable. Further technology like augmented reality helps us visualize complex data clearly, effectively, and efficiently. Thus, an application for weather forecasting with augmented reality is a must need for our future plans, trips or tours.

References

[1] Philippe Meister, Jack Miller, Kexin Wang, Michael C. Dorneich, Eliot Winer, "Using Three-Dimensional Augmented Reality to Enhance General Aviation Weather Training".

[2] Aruna R., Vasuki S., Dhanya M. R., Divya V., Gopika G. S., Harini M., Haritha P., "Weather Forecasting and Its Visualizations Using AI".

[3] Marko Heinrich, Bruce H. Thomas, Stefan Mueller, Christian Sandor, "An Augmented Reality Weather System".

[4] Stephan Rasp, Peter D. Dueben, Sebastian Scher, Jonathan A. Weyn, Soukayna Mouatadid, Nils Thuerey, "WeatherBench: A benchmark dataset for data-driven weather forecasting".