Cognizant UK

Cognizant UK

280 Bishopsgate London

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**Project Specifications Document**

**(Statement of Work)**



*Personalized Weather Forecast Video Generator using GenCast and AWS*

*April to September 2025*

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## 1. Project Title

*Personalized Weather Forecast Video Generator using GenCast and AWS*

## 2. Context : Gencast

GenCast is a cutting-edge probabilistic weather prediction model developed by DeepMind. Unlike traditional numerical weather prediction (NWP) systems, GenCast uses machine learning trained on decades of historical weather data to generate global forecasts. It produces 15-day forecasts in just 8 minutes, with 12-hour intervals and high spatial resolution (0.25° latitude-longitude), covering over 80 atmospheric and surface variables.

GenCast has demonstrated superior performance compared to the world-leading ECMWF ensemble forecast (ENS), outperforming it on 97.4% of evaluated targets. It is particularly effective at predicting extreme weather events, tropical cyclones, and wind power production. By offering faster and more accurate forecasts, GenCast represents a major advancement in operational weather forecasting, enabling better-informed decisions in weather-sensitive sectors.

*Source : Deep Minds open source Github repo, including the Gencast research paper and the Opensource model code and demo :* [***https://github.com/google-deepmind/graphcast***](https://github.com/google-deepmind/graphcast)

## 3. Project Overview

This project, conducted as part of an internship at Cognizant UK, aims to explore and demonstrate the capabilities of DeepMind’s GenCast weather prediction model. The goal is to design and develop a prototype application that generates personalized, smartphone-format weather forecast videos based on user-selected dates and locations. These videos will include visual elements such as maps and graphs, natural voice narration, and a virtual avatar to deliver the forecast. The forecast will cover a 72-hour period (the selected day plus two additional days) and will also communicate the uncertainty of the predictions.

The entire solution will be developed and hosted using AWS services, ensuring scalability, performance, and ease of deployment. A key part of the project involves evaluating the performance of different GenCast models, identifying the most suitable one for real-time applications, and exploring methods to increase the temporal resolution of predictions from 12-hour intervals to hourly forecasts. Additionally, the project will investigate the best sources of real-time weather data to feed into the GenCast model, ensuring accurate and up-to-date predictions.

The final deliverable will serve as a showcase for potential clients, demonstrating how GenCast can be adapted to meet specific business needs in sectors where weather forecasting is critical.

## 

## 4. Objectives

The primary objectives of this project are to explore, evaluate, and adapt DeepMind’s GenCast weather prediction model for practical, client-facing applications. A key deliverable is the development of a prototype that generates personalized weather forecast videos, tailored to user-selected locations and dates. This prototype will serve as a demonstration tool to showcase the potential of GenCast-powered forecasting solutions to clients across various industries, helping them envision how such technology can be customized to meet their specific operational needs.

## 5. Scope of Work

### **In Scope:**

* Integration with the GenCast model. (1deg model)
* Development of a user interface for selecting date and location.
* Generation of 1–2 minute smartphone-format videos with:
  + Forecast for selected day + 2 following days (72 hours).
  + Graphs, maps, and visual elements.
  + Natural voice narration.
  + Display of model uncertainty.
  + Visualise UK-specific output, even if the model runs globally
* Hosting and deployment on AWS.
* Performance evaluation of different GenCast models.
* Exploration of data sources for real-time weather input.
* Investigation into increasing prediction granularity from 12h to 1h.
* Evaluate methods for increasing time resolution.
* Virtual avatar Integration.

### **Out of Scope:**

* Generate forecasts using Google’s GenCast 0.25deg model
* Extend forecasts to 15 days, not relevant for near-term, actionable logistics use cases
* Rely on metadata manipulation (time-dilation) as a core solution, experimental only
* Retrain or fine-tune the GenCast model on UK-only input data, global context is required for model validity
* Develop real-time delivery platforms (e.g. mobile apps or live API services)

## 6. Deliverables

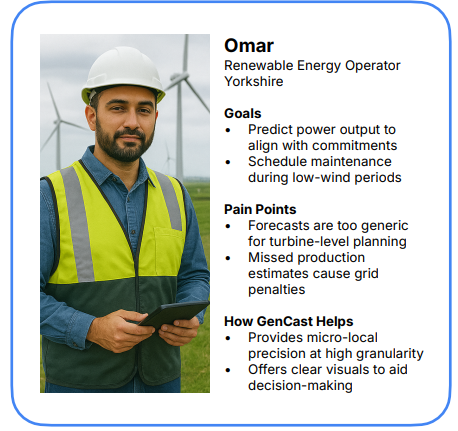
* Functional web-based UI.
* Automated video generation pipeline.
* Evaluation report on GenCast model performance.
* Documentation of AWS architecture and deployment.
* Demo video(s) for client showcase.
* Final presentation and project report.
* Video presentation of the project and its context

## 7. Constraints

The project faces several technical constraints that must be addressed to ensure a smooth and effective implementation. First, the GenCast model currently provides forecasts at a granularity of 12-hour intervals, which may limit the temporal resolution needed for detailed visualizations and user insights. Additionally, the availability and licensing of real-time weather data are critical factors, as the model relies on up-to-date observational inputs to generate accurate forecasts. Another key consideration is the video generation time, which must be optimized to ensure a seamless user experience without long delays. Finally, since GenCast is developed by Google and the project is being built on AWS infrastructure, ensuring compatibility and smooth integration between the two platforms is essential.

## 9. User Case: Forecasting for Offshore Wind Farms

One of the key user cases for this project is enabling offshore wind farm operators to receive personalized weather forecasts and performance insights. The user will be able to select a specific wind farm and a date, and the system will generate a short video forecast covering the selected day and the following two days (72 hours total).



The video will include:

* Wind conditions (speed, direction, gusts) at the wind farm location
* A performance score estimating how favorable the conditions are for energy production
* Estimated energy output, calculated based on the number and model of wind turbines at the site
* Visualizations such as output curves, wind maps, and uncertainty indicators
* A natural voiceover and virtual avatar presenting the forecast in a smartphone-friendly format

This use case demonstrates how the system can go beyond generic weather forecasting to deliver domain-specific insights that help clients in the renewable energy sector make informed operational decisions.

## 10. Technical Requirements

To successfully complete the project the technical skills required are the following :

1. AWS services (e.g., Lambda, S3, EC2, Bedrock, Sagemaker).
2. Python Intégration
3. Python Integration with GenCast model outputs.
4. Frontend framework (e.g., React, Vue).
5. Text-to-speech and avatar generation tools.
6. Data ingestion pipeline for real-time weather data.
7. HTML and CSS for the UI

## 

## 11. Success Criteria

To consider the project successful, the system must be capable of generating personalized weather forecast videos within a short response time, ideally under a defined threshold to ensure a smooth user experience. The forecasts produced should maintain a high level of accuracy, staying within acceptable error margins relevant to the use case. Additionally, the solution should receive positive feedback from internal stakeholders and potential clients, demonstrating its value and usability. Finally, the system must be designed with scalability and maintainability in mind, ensuring it can adapt to future enhancements and increased demand.

## 

## 12. Timeline :

The project is planned to be completed in 6 months, starting the 17ths of April 2025. The project will be divided in milestones, one milestone corresponding to one month of work :

1. Getting the smallest GenCast 1p0deg Mini <2019 model operational in Cognizant environment.
2. Learning GCP cloud environment to operate larger models remotely via BigQuery and VertexAI.
3. Learn how to build GenAI agents. Build a weather forecaster agent to represent the outputs provided by GenCast
4. Learn and create a virtual avatar using our SoulMachines licence to overlay
5. Create visuals of a weather forecast over England.
6. Merge the avatar and visual forecast to represent a demo of the results and capabilities, and limitations.

## 

## 13. Risks and Mitigation

| Risk | Description | Mitigation Strategy |
| --- | --- | --- |
| Model Accuracy | The GenCast model may not provide forecasts with sufficient accuracy for all use cases, especially in complex or offshore environments. This could reduce the reliability of the forecast videos. | Conduct early-stage evaluation of the model’s performance across different regions and timeframes. If necessary, use fallback models or ensemble methods to improve reliability. |
| Model Resolution | GenCast currently provides predictions at 12-hour intervals, which may not be granular enough for smooth visualizations or detailed energy output calculations. | Explore interpolation techniques or post-processing methods to simulate hourly forecasts. Investigate whether model fine-tuning or hybrid approaches can improve temporal resolution. |
| Prediction Variable Compatibility | The model may not output all the variables required for the video content, such as wind speed, direction, precipitation, or cloud cover. This could limit the richness of the forecast. | Identify all required variables during the design phase. If the model lacks certain outputs, supplement with external weather data sources or APIs to fill the gaps. |
| Real-Time Input Data Availability | The GenCast model relies on real-time observational data, which may be difficult to access, delayed, or subject to licensing restrictions. | Research and secure access to reliable, up-to-date weather data sources early in the project. Prioritize open datasets or establish partnerships with data providers. |
| AWS Compatibility | Some components of the system, such as avatar rendering or video generation, may not integrate smoothly with AWS services, potentially causing delays or technical issues. | Prioritize the use of AWS-native tools (e.g., MediaConvert, Polly, Lambda). Prototype early to identify integration challenges and adjust architecture accordingly. |
| Team Changes / Schedule Disruptions | As this is an internship project, changes in team availability or scheduling conflicts could disrupt progress or continuity. | Maintain thorough documentation, use version control (jira), and adopt agile practices to ensure flexibility and knowledge transfer. |