IoT-cloud based architecture is set to disrupt the operation and maintenance of smart grid systems in the fourth industrial revolution. The layered, hierarchical sensor network systems will no longer serve the dynamic, flexible, and mobile smart grid of the future. One of the approaches used in this work is the deployment of software defined networks (SDN). SDN modularizes the smart grid communication network by allowing virtual sensor clouds (VSC) to communicate with the physical sensor cloud (PSC) from disparate geographical areas all the while monitoring and managing the communication network and IoT sensor nodes performance using algorithms. In this paper, the performance of a communication network was determined against standard metrics to ensure foolproof, flexible, and sustainable system models.

First, the use case, as illustrated in Figure 1, was identified for the wind turbine in the offshore wind power plant for simulation. The identified use case was reviewed to identify the sensor nodes, current communication networks and protocols, performance metrics, and standard Quality of Service (QoS) matrix.

Diagram

Description automatically generated

Figure 1 Use Case study for the offshore wind power plant

These parameters were tabled and later assessed against their SDN based simulation results. Secondly, performance state estimate models were developed to monitor the communication network and the equipment energy consumption at the VSC. The performance state estimate models were used because they clearly demonstrated the legal and illegal states as designed in the model for QoS evaluation. Thirdly, Mininet was adopted as the most convenient tool to simulate the SDN environment for the use case and performance evaluation for the communication network. Lastly, the simulation results were tabled against the original parameter readings.

The data generated from the simulation results, having tested the use cases under different disturbance levels, inputs, and features, was used to plot network graphs to demonstrate the network behavior under these circumstances. This approach, however, was based on our models and approaches which were be deployed on the VSC for testing, therefore, giving a strong indicator of a potential scenario in any smart grid deployment in the energy sector.