**Title**: **Development of a Streamlit-Based Web Application for Well Log Visualization and Petrophysical Parameter Calculation Using Python**

**Name:**

**Matric Number:**

**Introduction**

This proposal outlines the development of an innovative web application utilizing Python and Streamlit for the comprehensive analysis and visualization of well log data. The application aims to take input well logs and well header information to produce well log displays, facies display, and calculate crucial petrophysical parameters such as porosity, permeability, water saturation, and volume of shale. By leveraging the capabilities of Python for data processing and Streamlit for user-friendly web application development, this project seeks to enhance the efficiency and accessibility of well log analysis for geoscientists and engineers.

**Recent Work:**

Recent advancements in well log analysis have leveraged various programming languages and software platforms to enhance data processing and visualization capabilities. MATLAB has been a prominent tool in this domain, favored for its extensive library of built-in functions and powerful computational abilities. Researchers like Smith et al. (2021) have utilized MATLAB to develop custom scripts for processing well log data, performing petrophysical calculations, and generating detailed visualizations. For example, MATLAB's Curve Fitting Toolbox and Statistics and Machine Learning Toolbox have been employed to model and predict petrophysical properties from well log data, providing a comprehensive solution for geoscientists and engineers (Smith et al., 2021). Additionally, MATLAB's App Designer facilitates the creation of interactive applications, streamlining data analysis workflows and making advanced techniques accessible to a broader user base (Jones and Lee, 2022). Java has also been instrumental in the development of standalone applications for well log analysis, particularly valued for its object-oriented programming features and platform independence. Researchers such as Brown and Zhang (2020) have developed Java-based applications that offer robust and scalable solutions for well log data processing and visualization, integrating various analytical tools and techniques. These applications often incorporate graphical user interfaces (GUIs) that enhance user interaction and data interpretation. Recent studies by Brown and Zhang (2020) have demonstrated the effectiveness of Java in creating comprehensive software solutions for the oil and gas industry, enabling detailed subsurface analysis and efficient resource management. By leveraging the strengths of these programming languages, recent work in the field has significantly advanced the capabilities of well log analysis and petrophysical parameter calculation (Brown and Zhang, 2020).

**Problem Statement**:

Current methods for well log analysis and petrophysical parameter calculation often rely on specialized software that can be costly and require extensive training. Additionally, these tools may not offer the flexibility or ease of access needed for rapid data interpretation and decision-making. There is a pressing need for a more accessible, customizable, and user-friendly solution that can streamline the analysis process and provide real-time visualization and interpretation of well log data.

**Aim and Objectives**:

Aim: To develop a Streamlit-based web application that facilitates the visualization of well log data and the calculation of key petrophysical parameters using Python.

**Objectives:**

1. To design a user-friendly web interface using Streamlit for inputting well log data and well header information,
2. To implement Python-based algorithms for the visualization of well logs and facies displays,
3. To develop robust Python scripts for calculating petrophysical parameters such as porosity, permeability, water saturation, and volume of shale,
4. To integrate real-time data processing and visualization capabilities within the web application,
5. To validate the application's accuracy and reliability by comparing calculated parameters with known values from existing datasets, and to
6. To provide detailed documentation and user guides to facilitate easy adoption and use of the web application by geoscientists and engineers.

**Methodology**

1. Data Acquisition and Preparation:

- Collect well log data and well header information from various sources.

- Format the data into a compatible structure for input into the web application.

2. Web Application Development:

- Use Streamlit to create an intuitive web interface for users to upload well log data and well headers.

- Develop interactive features for data input, parameter selection, and result display.

3. Data Visualization:

- Implement Python libraries such as Matplotlib and Plotly for visualizing well logs and facies displays.

- Ensure the visualizations are dynamic and can be customized based on user preferences.

4. Petrophysical Parameter Calculation:

- Develop Python algorithms for calculating key petrophysical parameters, including:

- Porosity: Using density and neutron logs to estimate porosity.

- Permeability: Using empirical correlations based on porosity and other well log data.

- Water Saturation: Applying Archie's equation and other relevant models.

- Volume of Shale: Analyzing gamma-ray logs to estimate shale content.

5. Integration and Testing:

- Integrate the data visualization and calculation modules into the Streamlit application.

- Test the application with real-world well log data to ensure accuracy and reliability.

- Perform validation by comparing the calculated parameters with known values from established datasets.

6. Documentation and User Support:

- Create comprehensive documentation, including a user manual and technical reference guide.

- Provide examples and tutorials to help users get started with the application.

**Expected Results:**

The expected outcomes of this project include the development of a functional web application capable of visualizing well logs and facies displays, and calculating petrophysical parameters with high accuracy. The application will offer an intuitive user interface, enabling geoscientists and engineers to efficiently analyze well log data and make informed decisions. Validation against known datasets will ensure the reliability of the calculated parameters, and detailed documentation will support widespread adoption and use of the tool.

**Contribution to Knowledge:**

This project will contribute to the field of geoscience and petroleum engineering by providing an accessible, flexible, and powerful tool for well log analysis and petrophysical parameter calculation. By integrating modern web development frameworks and advanced data processing techniques, the project will demonstrate the potential of leveraging open-source tools to enhance traditional workflows. The resulting application will facilitate more efficient data analysis, support informed decision-making, and contribute to the broader adoption of digital solutions in geoscience.

**Project Cost:**

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| **Project** | **Cost (₦)** |
| **Data Acquisition** | **10,000** |
| **Data Processing** | **10,000** |
| **API registration** | **5,000** |
| **Launching Space** | **10,000** |
| **Miscellaneous** | **20,000** |
| **Total** | **55,000** |