MAFMINE 3.1: Integrating Cost Estimation and ESG Constraints for Enhanced Preliminary Economic Assessment in Mining

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# ABSTRACT

MAFMINE 3.1 is a cost-estimation tool designed for mining operations, integrating Environmental, Social, and Governance (ESG) considerations. Evolving from the original O’Hara model, MAFMINE 3.1 leverages parametric models to provide preliminary CAPEX and OPEX estimations, achieving an accuracy of 30-50% suited for the Preliminary Economic Assessment (PEA) stage. It supports initial Discounted Cash Flow (DCF) calculations, enabling rapid, order-of-magnitude cost projections with minimal inputs.

This client-server application offers flexible deployment as both a cloud-based tool and a local desktop solution, using ElectronJS to support dual access. Local and synchronized cloud data storage is facilitated through PouchDB, which enables seamless data access in both online and offline modes. For the front end, a multilingual user interface is constructed with Handlebars and GruntJS, making it accessible to a global audience. Mathematical operations for cost and financial modeling are powered by MathJS, which supports quadratic and other complex equations foundational to mining project evaluations. Git version control allows for ongoing integration of new models and formulas, ensuring adaptability to future needs.

MAFMINE 3.1 also serves as an educational platform for mining engineering students and professionals, offering hands-on experience in cost estimation, financial modeling, and sustainability. ESG considerations, such as water stress, energy sourcing, and carbon footprint, are incorporated to align with modern standards for responsible resource management. This paper will discuss MAFMINE 3.1’s core functionalities, technical architecture, and practical applications in PEA-level mining assessments, underscoring its role as both a practical tool for cost estimation and an educational resource for sustainable mining practices.