" A PREDICTIVE MODEL FOR WATER PUMPS STATUS TO IMPROVE EFFICIENCY ON DELIVERY IN TANZANIA "

KEY RESULTS:

- IDENTIFIED THE FUNCTIONALITY OF THE PUMPS

- THE MODEL ACHIEVED 81% ACCURACY

- THE DATA WILL ENABLE BETTER DECISION MAKING & SERVICE DELIVERY

Performance of the Model

Model used: Random Forest Classifier
Accuracy: 81%

Key Metrics:
Fully Functional – F1: 0.85 | Precision: 0.81 | Recall: 0.89
Need repairs- F1: 0.41 | Precision: 0.55 | Recall: 0.33
Not functioning- F1: 0.81 | Precision: 0.84 | Recall: 0.78

Conclusion: The class of pumps that are functioning but need repairs is the hardest to predict

Key takeaways for the Management Company

A significant number of non-functional pumps might have been prevented through timely intervention & preventive maintenance.

Key Predictors of Pump Failure:
Construction Year – Older pumps show higher likelihood of failure
Region – Geographic disparities influence functionality
Management Type – Community or institutional oversight impacts performance
Installer – Quality and consistency vary by installation provider

The model enables **proactive identification of high-risk pumps**, allowing stakeholders to **forecast failures before they occur** and prioritize preventive maintenance.

Recommendations

- **Proactive Maintenance**
Prioritize inspections and repairs for pumps flagged as high-risk by the model.

- **Targeted Investment**
Direct funding and resources to regions with high failure rates to maximize impact.

- **Enhanced Data Collection**
Train field teams and standardize reporting formats to improve data quality and model accuracy.

- **Digital Monitoring**
Integrate sensors or mobile applications for real-time tracking and remote diagnostics.

- **Stakeholder Dashboard**
Develop an interactive platform to visualize pump functionality, risk levels, and predictive insights.

Impact Potential

Short-Term Benefits:

▶ **Reduced Downtime:** Minimize pump outages and mitigate water scarcity

▶ **Optimized Maintenance:** Enable efficient, predictive scheduling of repairs

Long-Term Benefits:

▶ **Cost Savings:** Decrease long-term repair and replacement expenses

▶ **Better Planning:** Support smarter infrastructure investment and resource allocation

▶ **Scalability:** Apply the model across broader water and utility systems

▶ **Community Trust:** Improve service reliability and stakeholder confidence