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An IOT based Machine Learning Model for Monitoring, Detecting, Predicting and Forecasting of Demand-side Water Consumption in Nakuru County by comparing Online and Offline Machine learning Approaches.

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Background

- Access to clean water and sanitation are basic human rights and critical development goals.
- Population increase (urban areas) will have a significant impact on the policies and regulations that will be set to govern distribution of water by utilities.
- Christian & Vegaeva (2018) suggest 2 that lack of water especially in the urban areas may possibly be attributed to poor governance
- Landon ward Nakuru county water crisis is inherently a result of poor management of water supply

Problem

- Poor management of water supply (Kenya National Water Development Report, 2006) due to poor water data, another reason is poor utilization of water supplied in the households

- Lovely (2018), increasing efficiency through curbing inessential water usage and reductions eases the burden on water supply.

Objectives of the Study.

Overall Objective

The overall objective is to build an IOT based machine-learning model for monitoring, detection, prediction and forecasting of demand-side water consumption within homesteads in Nakuru County.

Specific Objectives

a) To design a ML forecasting, Predicting and monitoring model.
b) To implement ML forecasting, Predicting and monitoring model.
c) To evaluate the performance of the ML model.

Literature

- According to Odongo (2014) study, he discovered 80% of the industries and commercial enterprises within Athi River Town employ forms of demand side management
- Long Short-Term Memory (LSTM) and the Back-Propagation Neural Network (BPNN) allows the prediction of amount of consumed water hourly with an error of some Litres (Boudhaouia & Wira, 2021)
- IoT based smart water quality monitoring system which monitors the quality parameters uninterruptedly (Lakshmikantha et al., 2021).

Methodology

- Conceptual Framework of the proposed system.
- Design Thinking process for the proposed model.
- Model Implementation.
- Model Evaluation Techniques.
- Model Monitoring and Maintenance

Results - Batch Training

- Offline models suffer from concept drift
- Offline models are horizontally scalable
- Offline model is easy to implement
- Offline models need less computational power
- Offline model’s robust approach.

Results - Online Training

- Online models need more computational power
- Online models are hard to implement
- Online models adjusts to the shift
- Online model are vertically scalable

Results - Automating Training

- Scheduling re-training and deployment of the model.
- The model is more recent than in batch.
- The model is more robust than an incremental model.
- Less computationally expensive to train this models.
- Industry standard approach.

Discussion / Implications

- Concept Drift.
- Best industry practices.
- Impact of water analysis in achieving sustainable development goals.

Conclusions

- Automating model re-training.
- Model relevance
- Customer and Business value
- Model Adoption

Future Work / Directions

- Self supervision time series models
- Making iterative models more robust.
- Adapting XAI in model retraining.

THANK YOU!