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Anti Theft Detection for Residual Electricity Utilization using Dtgg Method

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ABSTRACT: Illegal electricity users pose a significant threat to the economic and security aspects of the power system by illicitly accessing or manipulating electrical resources. With the widespread adoption of Advanced Metering Infrastructure (AMI), researchers have turned to leveraging smart meter data for electricity theft detection. However, existing models rely on methods that model a single electricity load curve and cannot capture the temporal dependencies, periodicity, and underlying features between electricity consumption cycles. This study introduces a novel electricity theft detection method based on dynamic residual graph networks. Innovatively, it proposes a dynamic topological graph construction technique that allows for the real-time updating of adjacency matrices during the training process, thereby effectively capturing the complex relationships in electricity usage patterns.

I. INTRODUCTION

Electricity theft is a problem that affects utility companies worldwide. More than $96 billion is lost by utility companies worldwide due to Non-Technical Losses (NTLs) every year, of which electricity theft is the major contributor [1]. In sub-Saharan Africa, 50% of generated energy is stolen, as reported by World Bank [2]. The ultimate goal of electricity thieves is to consume energy without being billed by utility companies [3], or pay the bills amounting to less than the consumed amount [4]. As a result, utility companies suffer a huge revenue loss due to electricity theft. [5] reports that in 2015, India lost.]. Apart from revenue loss, electricity theft has a direct negative impact on the stability and reliability of power grids [3]. It can lead to surging electricity, electrical systems overload and public safety threats such as electric shocks [4]. It also has a direct impact on energy tariff increases, which affect all customers [3]. Implementation of smart grids comes with many opportunities to solve the electricity theft problem [4].

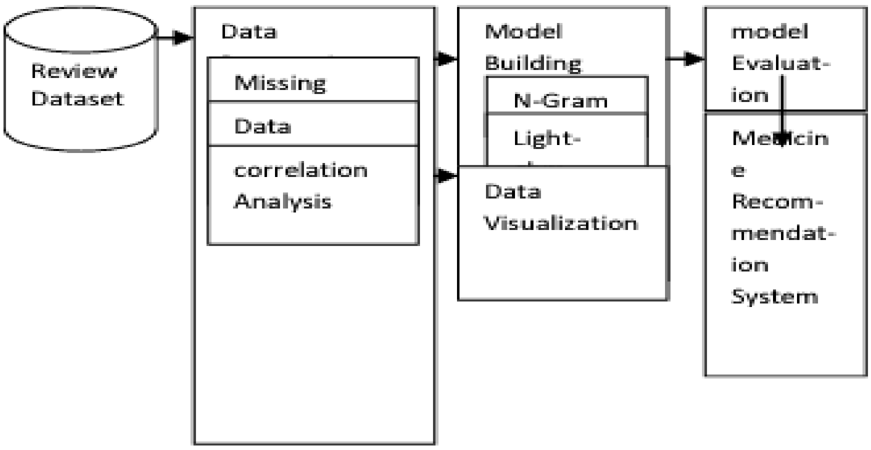

Figure 1: System Architecture

II. LITERATURE REVIEW

S. Foster. (Nov. 2, 2021). Non-Technical Losses: A $96 Billion Global OpportunityforElectricalUtilities.[Online].Available: https://energycentral.com/c/pip/non-technical-losses-96-

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billion- globalopportunity- electrical-utilities.

Aside from the considerable costs to utilities, energy theft hits customers hard as well. Those being billed for their legal consumption while regularly paying their bills are unknowingly subsidizing the thieves that aren't paying. What's more, the increased load on the system can result in power surges or electrical system failures – bad news for both customers and the utilities.

Whether through illegal connections to existing networks, tampering with or bypassing metering equipment, or refusal to pay for service, energy theft is clearly costly and prevalent – particularly in developing countries where many customers are unable to afford the bill. In fact, it is estimated that 50 percent of electricity in developing countries is acquired via energy theft.

Q. Louw and P. Bokoro, ``An alternative technique for the detection and mitigation of electricity theft in South Africa,'' SAIEE Afr. Res. J., vol. 110, no. 4, pp. 209216, Dec. 2019

Electricity theft and illegal connection by ground surface conductors is a pervasive problem in South Africa. The impact this phenomenon has is not only limited to revenue loss and equipment damage, but also presents a life threatening hazard. Although the issues of non-technical losses have been researched for decades, no universal solution has been presented, due to the complexity of the problem. This paper investigates the application of zero-sequence current-based detection as a mitigation strategy to deal with illegal connections by ground surface conductors. Simulation and experimental results show the validity of this technique as well as its dependence on seasonal change of the soil resistivity.

III. METHODOLOGY OF PROPOSED SURVEY

Programming improvement life cycle (SDLC) is a movement of stages that give an average understanding of the item assembling process. How the item will be perceived and made from the business understanding and necessities elicitation stage to change over these business contemplations and requirements into limits and features until its utilization and movement to achieve the business needs.The extraordinary computer developer should have adequate data on the most capable technique to pick the SDLC model taking into account the endeavour setting and the business requirements.

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IV. CONCLUSION AND FUTURE WORK

Our research introduces a DGRGNN (Dynamic Generative Residual Graph Neural Networks) model for detecting electricity theft behavior in smart grids. After simulation analysis on a real-world dataset, the following conclusions are obtained: We propose a dynamic topological graph generation method to update node connections during training. This approach provides more accurate node relationships with fewer parameters than static construction methods. • The model utilizes the mix-hop graph convolution network to better extract deep- seated temporal dependencies and periodic patterns within user electricity consumption data, resulting in improved detection performance. Furthermore, including residual connections increases the network's depth, effectively mitigating the issue of gradient explosions during training and enhancing the model's robustness. • To address the challenge of sparse electricity theft data, we employ the SMOTE method to augment minority class data and adjust class weights in the loss function. These methods effectively tackle class imbalance in the real dataset, enhancing the model's generalization capabilities.

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2. Learning python 5th Edition - this book is a practical learning book for basic to advanced level.

3. Python Cookbook - this book for advanced programmer interested in learning about modern python development tools.
4. Automating Boring Stuff With Python - In this book you will learn to write programs in python.
5. Head First Python - this book covered the fundamental of python.
6. Think Python - the basics of programming concepts and cover advanced topics like data structure and object-oriented design.

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