ARTIFICIAL INTELLIGENCE DRIVEN ENERGY MANAGEMENT OF A HYBRID MINI-GRID

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(20PCM02102)

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES OF COVENANT UNIVERSITY, OTA, OGUN STATE, NIGERIA IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF ENGINEERING (M.Eng.) DEGREE IN MECHANICAL ENGINEERING, IN THE DEPARTMENT OF MECHANICAL ENGINEERING, COLLEGE OF ENGINEERING, COVENANT UNIVERSITY, OTA.

JULY, 2022

ACCEPTANCE

This is to attest that this dissertation is accepted in partial fulfilment of the requirements for the award of the degree of Master of Engineering in Mechanical Engineering in the department of Mechanical Engineering, College of Engineering, Covenant University, Ota, Nigeria.

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DECLARATION

I, **BELLO, Ilesanmi Oluwayomi (20PCM02102)** declares that this research work entitled "**ARTIFICIAL INTELLIGENCE DRIVEN ENERGY MANAGEMENT OF A HYBRID MINI-GRID"** was carried out by me under the supervision of Prof. Olayinka Sunday Ohunakin of the department of Mechanical Engineering, College of Engineering, Covenant University, Ota, Nigeria. I attest that this dissertation has not been presented either wholly or partially for the award of any degree elsewhere. All sources of data and scholarly information used in this dissertation are duly acknowledged.

BELLO ILESANMI OLUWAYOMI

Signature and Date

CERTIFICATION

This is to certify that the research work titled "**ARTIFICIAL INTELLIGENCE DRIVEN ENERGY MANAGEMENT OF A HYBRID MINI-GRID"** is an original research work carried out by **BELLO, ILESANMI OLUWAYOMI** meets the requirements and regulations governing the award of Master of Engineering (M.Eng.) degree in Mechanical Engineering, from the Department of Mechanical Engineering, College of Engineering, Covenant University, Ota, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

I dedicate this work to my superhero, my dad, for his unfathomable support and cheering from day one.

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$E_s = E_d + E_L$ Equation 3.1 52

$E_d = E_C \times t$ Equation 3.2 52

$E_C = \sum_1^n P \; x \; t$ Equation 3.3 52

Min $E_s = E_d + E_L$ Equation 3.4 52

$3 \leq E_d \leq 65$ Equation 3.5 53

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ABSTRACT

With the driving theme of sustainability in our world today, it is imperative to consider approaches to reduce the carbon footprint on a global scale.

One critical area is in the generation and distribution of energy supply. In the management of energy, various methodologies have been implemented especially in the area of Demand Side Management where a lot of research work has been done.

However, while it is very important for the consumer to be very efficient in their consumption of energy, it is also quite critical that energy supply is properly managed such that even though the demand is optimized, the supply also needs to be properly optimized to avoid energy wastage.

This work has contributed to the ongoing research for Supply Side Management by adopting two heuristic artificial intelligence models – Fuzzy logic for intelligent decisions and Genetic Algorithm (GA) for optimizing the energy supplied to consumers. The fuzzy logic helps in predicting the demand and optimizing it for the required supply while the GA helps to clean up the minimization function for the optimization of the supply of energy.

This model is applicable to any energy system – on-grid and off-grid application.

Keywords: Fuzzy Logic, Genetic Algorithm, Energy management, Supply-side management