شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

HANAA ALY

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جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

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HANAA ALY

AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

Electronics Engineering and Electrical Communications

“Design and Implementation of Smart Energy Community Using IoT Technology”

A Thesis submitted in partial fulfilment of the requirements of the degree of

Master of Science in Electrical Engineering

(Electronics Engineering and Electrical Communications)

by

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Bachelor of Science in Electrical Engineering

(Electronics Engineering and Electrical Communications)

Faculty of Engineering, Ain Shams University, 2021

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Statement

This thesis is submitted as a partial fulfillment of Master of Science in Electrical Engineering, Faculty of Engineering, Ain shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

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Nesma Nour El Din Ali

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Thesis Summary

No one can deny the impact of energy consumption and its side effects on the financial situation and global environmental safety. Energy is known to be the second most expensive service after raw materials. As such, the importance of reducing energy consumption in manufacturing is the primary goal of industrial enterprises. Therefore, energy saving is a major issue for economic growth and the protection of the global environment. And since factories are considered the highest energy users ,improving the energy efficiency used in factories is an important goal for all industrial institutions, and therefore intensive research and thinking about different systems to reduce energy consumption is a primary goal for researchers, and from these systems are the factory energy management system (FEMS), And energy management systems (EMS). The Internet of Things (IoT) technology is a major contribution to energy management, as it can combine buildings with both machines and sensors.

It has been known for different generations that the widespread prevalence of the energy quality problem is due to the heavy use of non-linear loads, such as diode, consumer electronics, computers or power supplies, or offers non-standard voltage, frequency, or current waves in any electrical distribution systems and as such In this thesis, IoT-based architecture is proposed to detect non-linear loads and work out how to fix problems related to power factor limitation and harmonics. Therefore the main purpose

of this thesis is to maintain the acceptable percentage of energy efficiency and improve the overall level of energy quality of any system by restructuring on two main factors, harmonics and the energy factor to work to improve energy quality.

This thesis aims to provide suitable simulation models and programs to reduce energy consumption, and for that proposes a new structure that relies on reading real-time data to ensure prediction of the failure of the machine using energy quality data and methods to improve energy efficiency. To achieve this goal, a simulation program operating within the framework of the MATLAB was built with an emphasis on harmonics correction and power factor based on real-time monitoring of the energy file. Data was obtained in real time using the MQTT protocol to demonstrate the concept of meaning, reasoning and action.

Finally, a case study and analysis of the metal production line in the factories were conducted. This work represents energy analysis of the production lines of a metal plant in Egypt. Readings were made to monitor energy quality at each stage of the metal production and these readings such as voltage imbalance, current imbalance, power factor and harmonics demonstrate the concept of improving the power factor and removing distortion of harmonics using IoT technology.

Key words: Energy management system, IoT, Power Quality System, Non-Linear Loads, Energy efficiency, Voltage Unbalance, power factor, Harmonics.

List of Publications

1- N.N. Gomaa, K.Y. Youssef, M. Abouelatta, On design of IoT-based Power Quality Oriented Grids for Industrial sector, Advances in Science, Technology and Engineering Systems Journal (ASTES),2021

2- N.N. Gomaa, K.Y. Youssef, M. Abouelatta, “An IoT-based energy efficient system for industrial sector,” ICENCO 2019 - 2019 15th International Computer Engineering Conference: Utilizing Machine Intelligence for a Better World, 132–137, 2019, doi:10.1109/ICENCO48310.2019.9027440

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