



International Conference – Alternative and Renewable Energy Quest, AREQ 2017, 1-3 February 2017, Spain

Feasibility Study for Using Piezoelectric Energy Harvesting Floor in Buildings' Interior Spaces

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Abstract

Piezoelectric floors generate many microwatts up to many watts per step, depending on space pedestrians' frequency and piezoelectric technology. Although there are a number of earnest researches that have focused on harvesting power from piezoelectric floors tiles, the piezoelectric application is still hindered by many factors, which leads to the deprivation of the advantages of this technology. The research addresses how to get the Maximum benefits from piezoelectric energy harvesting floor in Buildings' interior spaces, according to the various weight of every usage factors, and through the integration of different kind of piezoelectric technology capabilities.

This Paper seeks to spread piezoelectric energy harvesting floor applications, through Facilitate how to conciliate and harmonize between the challenging requirement of usage factors and the application possibilities using a proposed tool. Feasibility study guide supported by various case studies that has been described as a benchmark for the future applications.

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Peer-review under responsibility of the organizing committee of AREQ 2017.

Keywords: Feasibility study; Renewable energy; Energy Transformation; Piezoelectric technology; Interior space; Floor.

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1. Introduction

Renewable and clean energy resources have become a demanded research area due to the problems facing energy shortage and environmental concerns using fossil fuel resources. The world electricity demand will increase by almost 80% during the period of 2012-2040 in the (IEA) International Energy Agency's New Policies Scenario. [1] The IEA believes that clean energy revolution is an essential need for the world in order to break dependence on fossil fuels. Such a revolution would enhance global energy security, promote Continuation of economic growth and tackle environmental challenges such as climate change. It would break the long-standing link between economic growth and carbon dioxide (CO₂) emissions. Energy harvesting technologies demand is growing as we continue to seek out greener and more efficient solutions. Like a wind generator or solar cells. Piezoelectricity is also a type of technology used for electrical energy harvesting from mechanical pressure such as walking motion.

Piezoelectric Energy harvesting floor as a sustainable clean energy is generating a usable electricity depending on people footsteps pressure, this valuable energy is wasted in spite of its available clean source (human movement). Public spaces piezoelectric floors can scavenge a reasonable amount of energy that can power electrical devices like lighting and screens. However, private offices or residential spaces are varying to use this technology due to the infeasible usage of the harvested amount of energy. Piezoelectric Energy has been applied in limited projects, opposed to the most widespread Renewable energies resources. The main factors that effect on piezoelectric technology usage are output power per step, battery storage, cost, consumption facility, number of users, distribution of high frequency walking areas and the method of utilizing this technology to get the optimal saving energy results, needing power to be used as main power or as a sensor triggering to manage the small amount of power needed to Locate users and direct a sufficient amount of power that meet their needs. This paper aims to facilitate using of piezoelectric technology by presenting the main types of this technology especially that used in harvesting energy floors, some of presented types are existing companies which have products, and other presented types are researches supported by experiments. Types' survey is followed by analytical brief. Correlation between factors has been presented as a preface for the suggested proposal and all its points are explained. Proposal was supported by using different case studies to clarify the sequence and the reliability of the proposal.

The Aim of this Paper is reaching a guide as a tool for architecture & interior architecture designers to facilitate embedding this technology in their designs as a part of the demanded low energy consumption in the buildings.

In addition,

- Utilizing piezoelectric technology as a clean energy which conserve environment and reduce CO₂ emissions that produced form the fuel recourses
- Saving energy consumption and direct the surplus toward investment
- Reducing electricity bill for the consumers and reach lower price category of electricity consumption

2. Main types of piezoelectric technology that used in energy Harvesting Floor.

Types of piezoelectric technology were classified according to the main technical specifications in (Table 1.) and by the same order according to uses and features (Table 2.), this main types is covering the factor of available products, the basis of the feasibility study.

Table 1. Piezoelectric technology types main technical specifications, price and lifespan.

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