UNIVERSITI TEKNOLOGI MARA

SMART PHONE-ENABLED MONITORING OF ACOUSTIC ENERGY HARVESTING FOR LOW POWER CHARGING SERVICES

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ABSTRACT

This study investigates the capability of Acoustic Energy Harvesters (AEH) in generating electricity to minimize electricity consumption. In AEHs, piezoelectric materials convert mechanical stress into electrical energy. It generates electricity with the application of stimulus such as pressure or sound. This thesis reports on the study of a commercial passive piezoelectric transducer effect on an energy harvesting circuit. Based on previous studies, the acoustic energy generated have been mostly used to power up high power devices, such as streetlights and low power devices, such as Wireless Sensor Nodes (WSN)s. Little is known on battery charging services employed using this source of harvested energy. Capitalizing on this potential, AEH could be used in low power charging applications such as mobile electronic gadgets. The methodology employed in this study is via the energy harvesting circuit based on Piezoelectric Acoustic Energy Harvester (PEAEH) technique. The resultant voltage produced by the PEAEH circuit is 3.53 Volts and is adequate to be used as a battery charger. The battery charging data are consequently fed into the monitoring serial monitor display and transmitted wirelessly via Wi-Fi. Finally, the study advocates the use of a smart phone application to monitor the remaining battery charging capacity with a notification function.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

This project investigates the capability of an energy harvester to minimize electricity consumption. Essentially, the focus is on the Acoustic Energy Harvesters (AEH) s in generating electricity to achieve this objective.

In AEHs, piezoelectric materials convert mechanical stress into electrical energy. It generates electricity with the application of some stimulus such as pressure or sound [1]. Original voltage from a piezoelectric material is very low, i.e. about 200mV to 2V, for an alternating electric signal [2, 3]. To get a reasonable output voltage, amplification and rectification has to be applied.

Currently, several studies have been performed on AEH to power up high power devices, such as streetlights [4-9] and low power devices, such as Wireless Sensor Nodes (WSN) s [10]. In Malaysia, researches have been done in order to lower power consumption [11, 12] via solar energy technique to mitigate high electricity utilization which normally amounts to one third of the electricity bill [13]. This effort had helped in reducing the electricity bill for street lighting. However, the unstable weather in Malaysia have influenced the amount of solar energy that could be harvested into the system. Due to this limitation, piezoelectric material has been introduced to supply renewable energy system [2]. Personal Computer (PC) based monitoring system has also been developed in order to maintain the amount of energy supply for street lighting purposes [11, 12]. Recent development of increasing electrical energy for