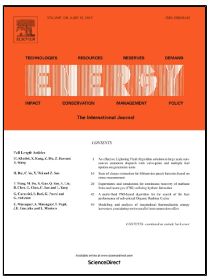
Accepted Manuscript



An Energy Prediction Algorithm for Wind-Powered Wireless Sensor Networks with Energy Harvesting

Selahattin Kosunalp

PII:	S0360-5442(17)30965-9
DOI:	10.1016/j.energy.2017.05.175
Reference:	EGY 10983
To appear in:	*Energy*
Received Date:	30 December 2016
Revised Date:	24 May 2017
Accepted Date:	28 May 2017

Please cite this article as: Selahattin Kosunalp, An Energy Prediction Algorithm for Wind-Powered Wireless Sensor Networks with Energy Harvesting, *Energy* (2017), doi: 10.1016/j.energy.2017.05.175

An Energy Prediction Algorithm for Wind-Powered Wireless Sensor Networks with Energy Harvesting

Selahattin Kosunalp

[1]*Department of Industrial Engineering, Faculty of Engineering, University of Bayburt, 69000 Bayburt, Turkey*
[2]*Central Research Laboratory, University of Bayburt, 69000 Bayburt,*

Email: skosunalp@bayburt.edu.tr

Abstract— Energy harvesting (EH) from environmental energy sources has the potential to ensure unlimited, uncontrollable and unreliable energy for wireless sensor networks (WSNs), bringing a need to predict future energy availability for the effective utilization of the harvested energy. The majority of previous prediction approaches have exploited the diurnal cycle dividing the whole day into equal-length time slots in which predictions were carried out in each slot independently. This is not, however, efficient for wind energy as it exhibits non-controllable behaviour in that the amount of energy to be harvested varies over time. This paper proposes a novel approach to predict the wind energy for EH-WSNs depending on the energy generation profile of latest condition. The distinctive feature of the proposed approach is to consider the recent conditions in current-day, instead of past-day's energy generation profiles. The performance of the proposed algorithm is evaluated using real measurements in comparison with state-of-art approaches. Results show that the proposed strategy significantly outperforms the two popular energy predictors, EWMA and Pro-Energy.

Index Terms— Energy harvesting, wind power, wireless sensor networks, energy prediction.

1. Introduction

The main body of wireless sensor networks (WSNs) includes a collection of resource-constrained sensor nodes performing a common task [1]. A typical sensor node senses an environmental parameter, such as temperature or movement, which is then processed to be transmitted to a central point, called sink or base-station. Sensor nodes are solely powered by limited small batteries as depicted in Fig. 1 with all components. Traditionally, sensor nodes are randomly deployed in harsh and remote areas where a physical access to the location of the sensor nodes is often impractical resulting in recharging or replacement of the battery a difficult task. The energy constraints of sensor nodes may limit the functions of the WSNs. A