Wireless sensor networks based smart bin

S.R. Jino Ramson∗, D. Jackuline Moni

Department of Electronics and Communication Engineering, Karunya University, Coimbatore 641 114, Tamil Nadu, India

ABSTRACT

This article presents the modelling of Wireless Sensor Networks (WSNs) to monitor unfilled level of bins through a central monitoring station and evaluation of wireless links. The nodes, called Wireless Monitoring Unit (WMU) are installed in each and every bins and the sensor present in the WMU measures the unfilled level of the bins and transmit the data to the Wireless Access Point Unit (WAPU). The WAPU receives data from the WMU’s and sends the data to the central monitoring station and the level of the bins are monitored by using an application. The current consumption, life expectancy of WMU and WAPU, data transmission distance between WMU and WAPU, wireless link quality and the surface level attainment between the system reading and manual reading have been compared and studied. Based on the obtained results the identified system can be implemented eminently for solid waste management.

© 2016 Elsevier Ltd. All rights reserved.

1. Introduction

A WSN is composed of large number of sensor nodes. The nodes are smaller in size, compared to other nodes in conventional networks, which sense the real time events, process the sensed data, and transmit the data to its target [1]. The basic block diagram of a WSN node is shown in the Fig. 1. The nodes of a WSN consist of a radio transceiver, microcontroller and sensors. The position of the nodes need not be pre-determined because they must possess the self-organizing capability.

Large numbers of smart sensors have been developed due to the deployment of WSN. Since large numbers of nodes are densely deployed, the neighbouring nodes will be very close to each other. Hence the low power consuming multi-hop communication is encouraged in WSN. Due to low cost, flexibility, high fidelity, self-organization, aggregated intelligence via parallel processing and rapid deployment [2], WSN is being applied in various fields [3–5] which are shown in the Fig. 2.

WSN plays a vital role in the field of real time monitoring. Several monitoring systems have been developed by using WSN for various applications such as monitor and protect wild animals [6], behaviour detection of elderly people [7], combustible gas monitoring [8], online dynamic torque and efficiency monitoring in induction motors [9], road traffic monitoring [10], building monitoring [11] and so on. Waste management is one of the applications which involves, the process of collecting the waste, transport, processing or disposal, managing and monitoring the waste materials. It is usually related to materials produced by human activity and the process is generally undertaken to reduce its effect on health and the environment.

The crucial problems in handling of solid wastes are given below:

∗ Reviews processed and recommended for publication to the Editor-in-Chief by Associate Editor Dr. M. H. Rehmani.
∗ Corresponding author.
E-mail addresses: jino@karunya.edu, jinoramson@gmail.com (S.R. Ramson), moni@karunya.edu (D.J. Moni).

http://dx.doi.org/10.1016/j.compeleceng.2016.11.030
0045-7906/© 2016 Elsevier Ltd. All rights reserved.

Please cite this article as: S.R.J. Ramson, D.J. Moni, Wireless sensor networks based smart bin, Computers and Electrical Engineering (2016), http://dx.doi.org/10.1016/j.compeleceng.2016.11.030
If the solid waste is planned to be collected daily, in case if the bins are unfilled, then it is the wastage of time, fuel and manpower.

If the solid waste is planned to be collected once in a week, in case if the bins overflow, it spreads around the area, causing illness to the public and pollutes the environment.

Smart bin level monitoring system using WSNs, resolves the crucial problems in handling solid waste and helps to keep the environment clean. The prime focus of this development is to stop the wastage of time, fuel, manpower, causing illness to the public and pollution. This paper demonstrates the detailed deployment of bin level monitoring system, evaluation of current consumption and wireless links. The major contributions of smart bin level monitoring system are as follows

√ Development of Wireless Monitoring Unit (WMU)
  • Interfaced Ultrasonic sensor (HC-SR04) with microcontroller MSP430F2274 present in eZ430-rf2500 development board.
  • eZ430-rf2500 programmed in the transmitter mode.
  • SimpliciTi protocol is used for the communication between WMU and WAPU.
√ Wireless Access Point Unit (WAPU)
  • eZ430-rf2500 programmed in the receiver mode.
  • Communication between WAPU and WMU is done by using SimpliciTi protocol.
  • Communication between WAPU and monitoring management software is done by using UART (Universal Asynchronous Receiver / Transmitter).
√ Monitoring Application
  • Uses C# programming language based on the .NET architecture.
  • Input from WAPU is given through serial port.
  • Different colours are used for different levels of bin.
√ Evaluation metrics:
  • Comparison between manual and developed system reading.
  • Calculation of current consumption of WMU and WAPU.
  • Evaluation of Life expectancy of WMU and WAPU
  • Determination of Maximum Throughput
  • Calculation of Packet Loss Rate
  • Determination of Wireless Link Delay.
  • Maximum transmission distance between WMU and WAPU.
    • Packet Loss Rate versus Distance
    • Packet Delivery Ratio versus Distance
  • Wireless link quality
دریافت فوری
متن کامل مقاله

امکان دانلود نسخه تمام متن مقالات انگلیسی
امکان دانلود نسخه ترجمه شده مقالات
پذیرش سفارش ترجمه تخصصی
امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
امکان دانلود رایگان ۲ صفحه اول هر مقاله
امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
دانلود فوری مقاله پس از پرداخت آنلاین
پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات