315/C

Design of a wireless sensor network for rice store monitoring

D N Balasuriya

Department of Electrical & Computer Engineering, Open University of Sri Lanka, Nawala

Extreme hunger prevailing in many of the third world countries is hindering the global development. Ever growing demand for food and the uneven distribution of the world's food consumption has been two main causes of this crisis. Simultaneously, waste of food due to aging, improper handling in transport and poor storage facilities are also fuelling the inadequate food supply for many. Rice, being a seasonal crop requires storage, usually carried out by filling into sacks and piling up in a store. However, most of these stores are of very poor quality and the grain sacks are susceptible to pest attacks and wetting. Wetting is a very serious issue which initiates sprouting, thus making rice unsuitable for human consumption. This study proposes a wireless sensor network (WSN) for monitoring such wetting conditions which is very beneficial in avoiding further damage. The key element of this WSN is the battery powered sensor node which is placed inside each and every sack during filling to detect two important parameters, namely temperature and the presence of moisture inside the sack. An LM35 temperature sensor and a DTH11 moisture sensor are employed in monitoring while an Arduino-Uno microcontroller collects the sensed information and then passes to the radio frequency (RF) communication module. Furthermore, one of the main contributions in this work is the introduction of a relay based communication from a sensing node to the external alarm notification unit. The relay based communication network facilitates a RF signal based communication over tens of meters of rice which is impossible to be achieved via a single point to point communication. Simultaneously, the sleep-wake up based power saving mechanism employed increases the battery life considerably, thus dramatically improving the node's lifetime close to one year. Its robust construction, power saving mechanism and also the capability to relay the sensed information to a monitoring station through many meters of rice makes this superior over many existing similar sensor networks. A prototype system with two sensor nodes and an alarm notification unit verified almost a 100% accuracy in communicating within 1m of rice. Moreover, the power efficiency of the proposed system is such that the node can survive 322 days without recharging, which is well within the requirements of a WSN. However, the system is limited by the cost of the communication devices. Nevertheless, improving the lifetime of the batteries further and the investigations on such power saving mechanisms would be an interesting future research area.

dnbal@ou.ac.lk Tel:+94 112881272