Design and Implementation of Sensor Network to Monitor Environmental Parameters of Blower Unit of Cotton Yarn Manufacturing Industry

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Abstract - In textile industry, monitoring of the environmental parameters such as temperature and humidity is essential. To maintain the quality of the cotton yarn, the environmental temperature and humidity is maintained at the précised level in textile industry. In fact, these parameters depict site specific variability (SSV). To play with such site specific data, deployment of the Wireless Sensor Network is most suitable solution. To monitor such parameters the wireless sensor network is established, wherein the wireless sensor nodes play a vital role. With the greater reliability and flexibility the wireless sensors nodes are designed, wherein ARM microcontroller, ARM LM4F120H5QR, is used as a core for computational task and RF transceiver module Xbee series-2, from DIGI International Inc, is used for Wireless Networking. Deploying embedded technology the sensor nodes have been designed for on-line monitoring of the two parameters such as, environmental temperature (^0C) and environmental humidity of the textile industry. The smart sensors, SY-HS-220 for humidity measurement and LM35 for temperature measurement are deployed. The signal conditioning and other analog part of the hardware is designed about CMOS based operational amplifiers MCP606. Ensuring the design of embedded system, both hardware as well as software is co-designed. Employing process of regression, the sensor nodes have been calibrated to the real units. The Refinement factor (R) is minimized and empirical relations are obtained. The empirical relations reveal the salient features of the sensor itself. The results shown by the nodes under investigation and that of obtained from standard instruments show close agreement. This reveals the reliability and accuracy in the hardware and software designed. Deploying such nodes and the coordinator, the wireless sensor network is established by employing Zigbee technology and implemented for monitoring of the dedicated parameters of the textiles industry. The results of implementation of WSN for monitoring of environmental parameters of textile industry are interpreted in present paper.
Keywords-- Sensor Node, Wireless Sensor Networks, XBee RF Module, ARM Microcontroller, Base Station.

I. INTRODUCTION

Recent advances in the electronics technologies results into revolutionary developments in fields of science and technology. Due to relentless efforts of scientists and technologists the fields such as Embedded Technology, Integration technology, communication technology, smart sensor design technology etc are pervasively growing and evolving innovative fields for research and developments [1-2]. On confluence of embedded technology and communication technology with computer technology, a novel field called Wireless Sensor Network is emerged [3]. Wireless sensor network provides new paradigm for sensing and disseminating information from various environments with a great potential to serve many and diverse applications [4]. The monitoring of various physical parameters such as temperature, fluid level, relative humidity, intensity of light, concentration of gasses dissolved in the atmosphere, vibrations, strain, soil moisture, industrial process parameters, pH and salinity of water etc plays commendable role in various sectors such as environmental pollution monitoring, high-tech agriculture, structural engineering, chemical and physical industries, transportation, military and defense, healthcare, forestry etc [5-9]. These physico-chemical parameters are depicting Site Specific Variability (SSV) and monitoring of such widely distributed parameters is challenging task. During early days, the wired networks have been deployed for monitoring of such parameters. However, the wired networks are not only infeasible for typical environment but also shows high cost, hardware complexity, hard to debug and upgrade. The wireless sensor network provides suitable solution to overcome the limitations of the wired system. The WSN is the application specific establishment of smart sensor nodes. The sensor nodes are systematically distributed over a geographical area of interest. The sensor nodes are intelligent and have capabilities such as sensing of physical environment, signal processing and wireless communication. Recently, an embedded