



ARM Microcontroller Based Wireless Sensor Network to Monitor Environmental Parameters of Textile Industry

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Abstract: *Indeed, Wireless Sensor Network (WSN) is an ubiquitous field, exhibiting wide application potential for electronic management of data of Site Specific and Temporal Variability (SSTV). Emphasizing real time monitoring of an indoor environment of textile industry, the WSN of five sensor nodes (SN) has been designed and by employing suitable wireless communication protocol, it is established to monitor relative humidity and environmental temperature of textile industry. The salient features of the SN decide reliability and preciseness of the WSN. Employing an embedded technology, the wireless sensors nodes have been designed, wherein ARM microcontroller, ARM LM4FI20H5QR, is used as a core for computational task. To facilitate wireless networking the Zigbee technology is availed, wherein the transceiver modules, Xbee series-2, have been incorporated. Typically, two sensors, humidity sensor (SY-HS-220) and temperature sensor (LM35), are interfaced, with suitable analog electronics, to the Sensor Nodes. Present sensor nodes have designed to follow IEEE 802.15.4 standards. Being a measuring instrumentation, the sensor nodes have been scientifically calibrated to the real units and standardized with sophisticated instrument as well. The Refinement factors (R) are optimized and resulting empirical relations have been incorporated into the firmware. The parameter values shown by the sensor nodes and that of obtained from the standard instruments found close match. This reveals the reliability and accuracy in the co-design of hardware and firmware. Deploying an IDE X-CTU, the SN have been configured for dedicated responsibilities such as End Devices (ED), Coordinator (C) and Router (R). The Wireless Sensor Network under investigation, for realization of on-site implementation, is established in the indoor environment of textile industry. Instantaneous values of parameters are recorded, in real time, in the dedicated data base and demonstrated on smart GUI of the Base Station as well. Results of implementation support the deployment of present WSN for industrial applications.*

Keywords- *Wireless Sensor Network, Zigbee Technology, ARM Microcontroller, Environmental monitoring, Textile industries.*

I. INTRODUCTION

Wireless sensor network (WSN) is an innovative technology and it has been proved its suitability for various sectors. It depicts an enormous potential for industrial and commercial applications [1-3]. The wireless sensor network is an establishment of systematically distributed sensor nodes, who have the capabilities of sensing as well as computation [4]. The nodes are autonomous and sense the information about various parameters within grid of defined area [5]. Each node solders the responsibility of its own grid. Therefore, the nodes interact with the physical world and collect site specific information at the base station [6]. Thus, the WSN is most suitable for collection of information spread over wide area. On intensive study, it is found that, the WSN is significantly used for precision agriculture [7], wherein, the parameters of spatio-temporal variations should be essentially monitored. The WSN also proved its suitability for monitoring transportation, environmental monitoring, forecasting, pollution monitoring, security, disaster management etc [8]. Moreover, it is most suitable for monitoring of industrial parameters. In industry various physico-chemical parameters are to be monitored. For monitoring of such parameters, at present, wired networks have been deployed by many industries. However, use of wired network has its own constraint due to hardware complexity and ultra high power consumption. Therefore, the paradigm shift from wired to wireless networking is realizing. Therefore, for monitoring of industrial parameters, the WSN can play commendable role.

In case of industry, various physico-chemical parameters such as temperature, pressure, humidity of environment, leakages of various gases, water quality, pollution due to industrial waste, pH of solution etc have to be monitored by sophisticated electronic system, wherein the centralized monitoring is emphasized. Such localized system could not collect the information of site specific variability. The wireless sensor network is most suitable technology to cater this need. Out of the above parameters, the temperature of the environment and humidity in the textile industrial environment are considered for present investigation. These parameters can be collected through the network of sensor nodes, wirelessly connected to each other and to the base station as well. According to standard architecture the node has a processing unit, memory unit, RF transceiver module, power source and an array of sensors as well. The sensor node communicates