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A Survey on Agriculture Monitoring Using Wireless Sensor Network

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Abstract-Wireless sensor network is an autonomous network which consists of resource constraints sensor motes which are used to capture various events of interest such as temperature, humidity and pressure. These networks are used in many areas like agriculture monitoring, health care monitoring, forest fire monitoring, environmental monitoring etc. These networks are used to monitor various agriculture products or various parameters in agriculture such as the quality of fruits, vegetables, the amount of oxygen and nitrogen required. In this paper we aim to present the existence studies of wireless sensor networks which are used for agriculture monitoring. We will explain in details the advantages and dis advantages of the existing studies and we present our own analysis and conclusion.

Keywords: Wireless Sensor Network, Agriculture Monitoring, Sensor Node, Fertilizers

I. INTRODUCTION

Nowadays agriculture required technology to increase the production quality. The sensor field in agriculture may bring out the fundamental contribution to precision agriculture. The precision agriculture is defined as the method of applying the correct amount of input (water, fertilizer, nitrogen etc.) at the accurate location and at the accurate time to increase production and improve quality, while protecting the environment.

WSN is a wireless network consisting of spatially distributed autonomous devices using sensors to cooperatively monitor physical or environmental conditions. Each node consists of processor, have a RF transceiver (Omni-directional antenna), have a power unit (e.g. AA batteries, quartz cells and solar cells) and accommodate various sensors. The nodes communicate wirelessly.

II. PROBLEM DEFINITION

Farmer experiences huge economic losses due to wrong prediction about weather and wrong irrigation method. When the Wireless Sensor Network is developed now it is very easy to apply them for increasing the quality and quantity of crops. Nowadays it is huge problem because of unawareness about the techniques methodologies and tools used and type of soil content, type of fertilizers to be added. Currently inquiry of soil to increase quantity of crop production is not utilized very much due to

the high price. As there is very big field for crop so the soil sample cannot be efficient to send to lab which will represent the whole land because whole land has different types of soil.

To use sensor motes it is computationally high in terms of energy. The achievement of sensor motes applications is based on consistent transmission of data packets among sensor motes. One of the major problems in WSN environments is the resource starvation problem. High energy is spent in data transmission from sensor nodes to the base station.

III. LITERATURE REVIEW

The suggested irrigation management system in [1] which was utilizing intelligent humidity sensor and low power SWT for facilitating irrigation management. The monitoring device used in this paper is laptop/computer. The proposed system in [2] determines the soil moisture and necessity of water to crop in order to supply just the right amount of water just enough to maintain moisture level. A microcontroller is used to control the operation along with relay switch and pump. The proposed system in [3] uses the sensor node that include JN5121 module, an IEEE 802.15.4/zigbee wireless microcontroller. GPRS gateway was used for long distance data transmission. The mobile unit was used as monitoring device.

The proposed system in [4], a study of zigbee based wireless sensor network in agriculture was carried out. This paper has reviewed few issues regarding zigbee in agriculture, i.e., how the factors like node spacing, antenna height, and density of leaves affects the signal strength. The energy efficient WSN for agriculture proposed in [5] uses the sensor node equipment with CC1110 system on chip with low power RF Tran's receiver and 8051 MCU from texas. A CC 1110 evaluation module plugged into smart RF04 evaluation board who's LCD and LED buttons are readily available for monitoring and control. The hardware allows radio transmission in multiple power levels and also allow user to change receiver sensitivity. The proposed system in [6] also

includes the camera nodes and cattle sensor network along with the soil moisture sensor.

The instrument in [7] [9] [10] is designed to monitor the soil temperature and humidity of agriculture environment. The tests were done to verify the reliability and accuracy of the temperature and humidity monitoring system. Two different sets of test were conducted i.e. in close room and open room environment [7] [11-22]. The position estimation of sensor nodes in WSN for precision agriculture generally include errors and it is concluded that the average value of localization error decreases with the signal propagation coefficient and proved that the robustness of NMDS (nonmetric multidimensional scaling) algorithm for bad environment [8] [23-29].

IV. PROPOSED WORK

Pakistan is one of the World's largest mangoes production country. Its requirement for water and fertilizer are equally high. Heat, humidity and sunlight plays important role in mangoes growth, vegetative growth and ripeness. Mangoes grow well in humid and hot weather. It requires humidity of 70% for more vegetative growth.it is clear that growth of mangoes crop is highly dependent on few climatic factors like air temperature, humidity, and soil temperature and soil moisture. So it is essential to monitor few climatic conditions for the better yield of mangoes.

This paper would take the opportunity to build a device that is able to monitor the humidity, temperature , and soil temperature and send it to a remote receiver which will be outside the field. The system represented in this paper consists of the microcontroller, base station, nodes, device control node and mobile phone. The WSN data collecting node is connected with temperature, soil moisture and humidity sensor. When these sensor nodes find an irregular or improper environment condition of the soil the nodes will send alarm signal to base station which will be encoded. Once the base station receives an alarm signal, it will send a SMS to farmer through the GSM module and GSM network immediately.

a) Sensor node

The sensor node is very important unit of the environmental monitoring information system; its task is to attain collection, perception, processing and wireless communication of environmental data.

A node consists of four basic components which are sensor, power unit, processor and radio transceiver. The sensor converts such measured physical quantities as temperature, humidity etc. into a voltage signal and digitizes it to produce digital output for processing. The processor with a microcontroller controls all of the functions of the sensor node and manages the communication protocols to carry out specific tasks [30-39]. Communication between the WSN node and the base station is provided by the Radio transceiver unit. And finally the power unit, which is the most essential component of a sensor node, supplies power to all of these units.

b) *Base station unit*

This unit is responsible for collecting the data from all the sensor nodes [40-49] and critically evaluates the data, if it finds an abnormal or unsuitable environment condition of the soil, the base station send a SMS to farmer through the GSM module and GSM network immediately.

V. CONCLUSION

The proposed system in this paper is designed by considering the requirement of a mangoes crop for Pakistan weather. The WSN in agriculture is new technology for information gaining and processing in mangoes field. It is more beneficial than the traditional agriculture techniques. This is low cost system where the recorded information is transmitted to remote location using a GSM network via a SMS. The farmer may use the received information to control the parameters. This kind of wireless detection and control improves the effectiveness and efficiency of resources used, which leads to the improved production. The drawback of system is its dependency on the GSM network.

REFERENCES

[1]. Kshitij shinghal, Dr. Arti noor, Dr. Neelam srivastava, Dr. Raghuvir singh, wireless sensor networks in agriculture: for potato farming.

[2]. Prakash gaud patil, vidya h2, shreedevi patil, umakant kulkarni, wireless sensor network for precision agriculture, 2011.

[3]. Jianfa Xia, Zhenzhou Tang, *Xiaoqiu Shi, Lei Fan, Huaizhong Li, An environment monitoring system for precise agriculture based on wireless sensor networks, 2011.

[4]. A Survey on Zigbee Based Wireless Sensor Networks in Agriculture T.Kalaivani, A. Allirani, P.Priya, 2011 IEEE.

[5]. Herman Sahota Ratnesh Kumar Ahmed Kamal Jing Huang, an Energy-efficient Wireless Sensor Network for Precision Agriculture, 2010 IEEE.

[6]. Tim Wark, Peter Corke, Pavan Sikka, Lasse Klingbeil, Ying Guo, Chris Crossman, Phil Valencia, Dave Swain, and Greg Bishop Hurley, Transforming Agriculture through Pervasive Wireless Sensor Networks, 2007 IEEE

[7]. Application of Wireless Sensor Networks For Agriculture Parameters, Awati J.S.1, Patil V.S.2 And Awati S.B, International Journal of Agriculture Sciences Issue 3, 2012, PP-213-215.

[8]. Localization algorithms in wireless sensor networks using Non metric Multidimensional scaling with RSSI for precision agriculture, Xihai Zhang, Yachun Wu, Xiaoli Wei, 2010 IEEE.

[9]. Research of Temperature and Humidity Monitoring System Based on WSN and Fuzzy Control Xinrong Zhang, Bo Chang, 2011 IEEE.

[10]. A Low-Power Temperature and Humidity Monitoring System Base on Wsn J.J. LI, F. WANG*, 2011.

[11]. Khan, F., & Nakagawa, K. (2013). Comparative study of spectrum sensing techniques in cognitive radio networks. In *Computer and Information Technology (WCCIT), 2013 World Congress on* (pp. 1-8). IEEE.

[12]. Khan, F., Bashir, F., & Nakagawa, K. (2012). Dual head clustering scheme in wireless sensor networks. In *Emerging Technologies (ICET), 2012 International Conference on* (pp. 1-5). IEEE.

[13]. M. A. Jan, P. Nanda, X. He, and R. P. Liu, "A Lightweight Mutual Authentication Scheme for IoT Objects," *Future Generation Computer Systems (FGCS)*, "Submitted", 2016.

[14]. Khan, F., Kamal, S. A., & Arif, F. (2013). Fairness improvement in long chain multihop wireless ad hoc networks. In *2013 International Conference on Connected Vehicles and Expo (ICCVE)* (pp. 556-561). IEEE.

[15]. Khan, F. (2014). Secure communication and routing architecture in wireless sensor networks. In *2014 IEEE 3rd Global Conference on Consumer Electronics (GCCE)* (pp. 647-650). IEEE.

[16]. M. A. Jan, P. Nanda, X. He and R. P. Liu, "PASCCC: Priority-based application-specific congestion control clustering protocol" Computer Networks, Vol. 74, PP-92-102, 2014.

[17]. Khan, S., & Khan, F. (2015). Delay and Throughput Improvement in Wireless Sensor and Actor Networks. In *5th National Symposium on Information Technology: Towards New Smart World (NSITNSW)* (pp. 1-8).

[18]. Khan, F., Jan, S. R., Tahir, M., Khan, S., & Ullah, F. (2016). Survey: Dealing Non-Functional Requirements at Architecture Level. *VFAST Transactions on Software Engineering*, *9*(2), 7-13.

[19]. Khan, F., & Nakagawa, K. (2012). Performance Improvement in Cognitive Radio Sensor Networks. *the IEICE Japan*.

[20]. Khan, F., Khan, S., & Khan, S. A. (2015, October). Performance improvement in wireless sensor and actor networks based on actor repositioning. In *2015 International Conference on Connected Vehicles and Expo (ICCVE)* (pp. 134-139). IEEE.

[21]. M. A. Jan, P. Nanda, X. He and R. P. Liu, "A Sybil Attack Detection Scheme for a Centralized Clustering-based Hierarchical Network" in Trustcom/BigDataSE/ISPA, Vol.1, PP-318-325, 2015, IEEE.

[22]. Jabeen, Q., Khan, F., Khan, S., & Jan, M. A. (2016). Performance Improvement in Multihop Wireless Mobile Adhoc Networks. *the Journal Applied, Environmental, and Biological Sciences (JAEBS)*, *6(4S)*, 82-92.

[23]. Khan, F. (2014, May). Fairness and throughput improvement in multihop wireless ad hoc networks. In *Electrical and Computer Engineering (CCECE), 2014 IEEE 27th Canadian Conference on* (pp. 1-6). IEEE.

[24]. Khan, S., Khan, F., Arif, F., Q., Jan, M. A., & Khan, S. A. (2016). Performance Improvement in Wireless Sensor and Actor Networks. *Journal of Applied Environmental and Biological Sciences*, *6(4S)*, 191-200.

[25]. Khan, F., & Nakagawa, K. (2012). B-8-10 Cooperative Spectrum Sensing Techniques in Cognitive Radio Networks. *電子情報通信学会ソサイエティ大会講演論文集*, *2012*(2), 152.

[26]. M. A. Jan, P. Nanda, X. He, and R. P. Liu, "A Lightweight Mutual Authentication Scheme for IoT Objects," *Elsevier Future Generation Computer Systems (FGCS)*, "Submitted", 2016.

[27]. Khan, F., Jan, S. R., Tahir, M., & Khan, S. (2015, October). Applications, limitations, and improvements in visible light communication systems. In*2015 International Conference on Connected Vehicles and Expo (ICCVE)*(pp. 259-262). IEEE.

[28]. Jabeen, Q., Khan, F., Hayat, M. N., Khan, H., Jan, S. R., & Ullah, F. (2016). A Survey: Embedded Systems Supporting By Different Operating Systems. *International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Print ISSN*, 2395-1990.

[29]. Jan, S. R., Ullah, F., Ali, H., & Khan, F. (2016). Enhanced and Effective Learning through Mobile Learning an Insight into Students Perception of Mobile Learning at University Level. *International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Print ISSN*, 2395-1990.

[30]. Jan, S. R., Khan, F., & Zaman, A. The perception of students about mobile learning at University level.

[31]. M. A. Jan, P. Nanda, X. He, and R. P. Liu, "A Sybil Attack Detection Scheme for a Forest Wildfire Monitoring Application," *Elsevier Future Generation Computer Systems (FGCS)*, "Accepted", 2016.

[32]. Jan, S. R., Shah, S. T. U., Johar, Z. U., Shah, Y., & Khan, F. (2016). An Innovative Approach to Investigate Various Software Testing Techniques and Strategies. *International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Print ISSN*, 2395-1990.

[33]. Khan, I. A., Safdar, M., Ullah, F., Jan, S. R., Khan, F., & Shah, S. (2016). Request-Response Interaction Model in Constrained Networks. *In International Journal of Advance Research and Innovative Ideas in Education, Online ISSN-2395-4396*

[34]. Azeem, N., Ahmad, I., Jan, S. R., Tahir, M., Ullah, F., & Khan, F. (2016). A New Robust Video Watermarking Technique Using H. 264/AAC Codec Luma Components Based On DCT. *In International Journal of Advance Research and Innovative Ideas in Education, Online ISSN-2395-4396*

[35]. Drira, Wassim, Deepak Puthal, and Fethi Filali. "ADCS: An adaptive data collection scheme in vehicular networks using 3G/LTE." In 2014 International Conference on Connected Vehicles and Expo (ICCVE), pp. 753-758. IEEE, 2014.

[36]. Jan, S. R., Khan, F., Ullah, F., Azim, N., & Tahir, M. (2016). Using CoAP Protocol for Resource Observation in IoT. *International Journal of Emerging Technology in Computer Science & Electronics, ISSN: 0976-1353*

[37]. Azim, N., Majid, A., Khan, F., Jan, S. R., Tahir, M., & Jabeen, Q. (2016). People Factors in Agile Software Development and Project Management. *In International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE)* ISSN: 0976-1353

[38]. Azim, N., Majid, A., Khan, F., Tahir, M., Safdar, M., & Jabeen, Q. (2016). Routing of Mobile Hosts in Adhoc Networks. *In International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE)* ISSN: 0976-1353.

[39]. *Azim, N., Khan, A., Khan, F., Majid, A., Jan, S. R., & Tahir, M. (2016) Offsite 2-Way Data Replication toward Improving Data Refresh Performance. In International Journal of Engineering Trends and Applications,* ISSN: 2393 – 9516

[40]. Tahir, M., Khan, F., Jan, S. R., Azim, N., Khan, I. A., & Ullah, F. (2016) EEC: Evaluation of Energy Consumption in Wireless Sensor Networks. . *In International Journal of Engineering Trends and Applications,* ISSN: 2393 – 9516

[41]. Puthal, Deepak, B. P. S. Sahoo, Sambit Mishra, and Satyabrata Swain. "Cloud computing features, issues, and challenges: a big picture." In*Computational Intelligence and Networks (CINE), 2015 International Conference on*, pp. 116-123. IEEE, 2015.

[42]. M. A. Jan, P. Nanda, M. Usman, and X. He, "PAWN: A Payload-based mutual Authentication scheme for Wireless Sensor Networks," *Concurrency and Computation: Practice and Experience*, "accepted", 2016.

[43]. Azim, N., Qureshi, Y., Khan, F., Tahir, M., Jan, S. R., & Majid, A. (2016) Offsite One Way Data Replication towards Improving Data Refresh Performance. *In International Journal of Computer Science Trends and Technology,* ISSN: 2347-8578

[44]. Safdar, M., Khan, I. A., Ullah, F., Khan, F., & Jan, S. R. (2016) Comparative Study of Routing Protocols in Mobile Adhoc Networks. *In International Journal of Computer Science Trends and Technology,* ISSN: 2347-8578

[45]. Tahir, M., Khan, F., Babar, M., Arif, F., Khan, F., (2016) Framework for Better Reusability in Component Based Software Engineering. *In the Journal of Applied Environmental and Biological Sciences (JAEBS), 6(4S)*, 77-81.

[46]. Khan, S., Babar, M., Khan, F., Arif, F., Tahir, M. (2016). Collaboration Methodology for Integrating Non-Functional Requirements in Architecture. *In the Journal of Applied Environmental and Biological Sciences (JAEBS), 6(4S)*, 63-67

[47]. Puthal, Deepak, Zeeshan Hameed Mir, Fethi Filali, and Hamid Menouar. "Cross-layer architecture for congestion control in Vehicular Ad-hoc Networks." In *2013 International Conference on Connected Vehicles and Expo (ICCVE)*, pp. 887-892. IEEE, 2013.

[48]. Jan, S.R., Ullah, F., Khan, F., Azim, N., Tahir, M., Khan, S., Safdar, M. (2016). Applications and Challenges Faced by Internet of Things- A Survey. *In the International Journal of Engineering Trends and Applications,* ISSN: 2393 – 9516

[49]. Tahir, M., Khan, F., Jan, S.R., Khan, I.A., Azim, N. (2016). Inter-Relationship between Energy Efficient Routing and Secure Communication in WSN. *In International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE)* ISSN: 0976-1353.