QRIC: QoS Aware Routing for Internet of Things in College Management system

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***Abstract*: The Internet of Things is the future internet where everyday objects are connected to the internet. The rapidly increasing number of interconnected devices creates number of issues which need to be addressed. Since IoT devices are energy constrained, energy must be saved at different levels. The network has mobile nodes as well as static nodes. Managing an organization like college is not so easy. This paper proposes College Automation System (CAS) using IoT. CAS involves different modules to achieve efficient management. This paper particularly deals with efficient routing for staff management. In IoT nodes are energy constrained therefore energy efficiency in routing need to consider. The proposed technique QoS aware Routing for Internet of Things in College Management system (QRIC) achieves QoS by selecting energy efficient path.**

Key words— Internet of Things, Routing protocol, Energy, QoS.

I. INTRODUCTION

The Internet of Things (IoT) is one of the future internet technologies and a new paradigm. It combines technologies such as ubiquitous computing, pervasive computing, internet protocol, sensing technologies and communication technologies etc. The Internet of Things (IoT) applications span a wide range of domains including homes, cities, environment, energy systems, retail, logistics, industry, agriculture and health. This paper provides an overview of IoT applications in college management system.

Since millions of devices are connected to the internet and the devices are energy constrained, energy saving is an important factor in IoT. In order to increase the life time of a sensor node and network, energy must be saved at different levels.

The college management system using IoT includes several modules namely student management, staff management, smart monitoring, etc. The system architecture is given in Figure 1. In each module there exists several issues such as security, routing, data management, etc. which are need to be addressed, ensuring optimum routing increases the network lifetime.

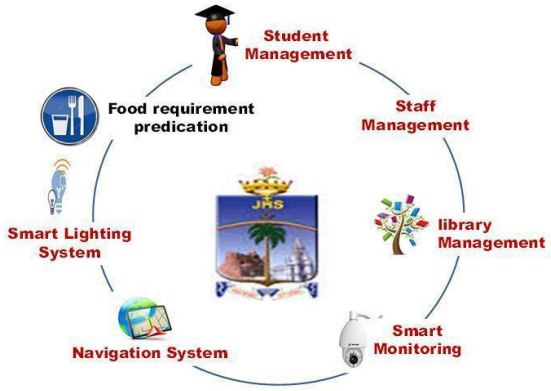

Figure 1. College Management System

II. RELATED WORKS

Rongxing et al. [1] proposed an activity scheduling scheme for sensing coverage. A node was considered if its sensing range was fully covered by sensing ranges of a connected set of active neighbors.

Shyam et al. [2] explored the potential EER barriers with examples and suggested scheduling scheme as remedies. The scheme required time to be slotted and activity scheduling was done in rounds. In each round, a node selected a random timeout and listened to messages from neighbors before it got expired. The node made its own activity decision and announced it to the neighbors by transmitting a message. The scheme involved local communication and generated a very small number of control messages, thus being energy efficient.

Sang-Hyun Park et al. Proposed EEPR algorithm which employed both ETX metric and residual energy of each node [3]. Another metric used in the work was the residual energy of a node which showed efficiency of energy consumption in the networks. There are also some other routing techniques that use shortest path as optimum are listed in the table 1.

Richardson et al. proposed a system which comprised of h\w devices connected with the web server [11]. The embedded web server hosts RESTful web services to communicate with the cloud server. Using this way the energy consumption was said to be directly proportional to device utilization.

Table 1: Related works

Author	Title	Year
Quercia, Daniele et. al.[4]	The shortest path to happiness: Recommending beautiful, quiet, and happy routes in the city	2014
Kristiant o et. al.[5]	"A model of resilient supply chain network design: A two-stage programming with fuzzy shortest path.	2014
Nanongkai et. al.[6]	Distributed approximation algorithms for weighted shortest paths	2014
Villas et. al.[7]	A spatial correlation aware algorithm to perform efficient data collection in wireless sensor networks.	2014
Sundar et. al.[8]	Algorithms for routing an unmanned aerial vehicle in the presence of refueling depots	2014
Qi-Bo, et al [9]	Internet of Things: Summarize on Concepts, Architecture and Key Technology Problem	2010
Sampath Kumar et. al.[10]	"Use of ICT in college libraries in Karnataka, India: a survey	2010

III. QRIC: A PROPOSED TECHNIQUE

The automation of college management is complex due to the heterogeneity of devices. In college automation various modules are involved as shown in figure 1. In each module, different kinds of nodes are involved like mobile node, static node, mobile energy constrained node, static energy harvesting node, etc. The network between nodes is established using different Technology like Bluetooth, Wi-Fi, cellular technologies. The nodes using radio wave as communication medium have only limited transmission range. This makes the routing further complex. The proposed technique QRIC chooses the efficient path to transfer data. The proposed technique chooses the path with node having zero energy deficiency even though the path has less delay.

In college, there are many departments. Each department is considered as a unit. Numbers of devices are connected to each department for different purposes. All these devices are connected to the cloud via Wi-Fi, Bluetooth or any other connecting Technology. The staff management is a module in college management. The staff management is explained in figure 2.

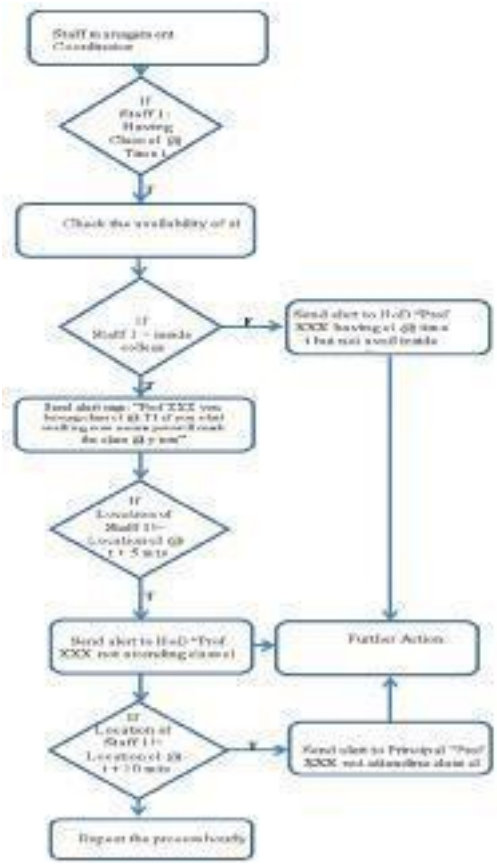

Figure 2. Staff Management

The alert message is sent to staff before the class starts. If the staff fails to go to class, then the information will be sent to HOD. If the HOD does not take any action, then the information will be sent to the principal. Here the staff, HOD and principal are mobile nodes. The coordinator node needs to communicate with staff node. Initially the source node sends the probe message to identify the available paths to the destination node. The source node chooses the efficient path for communication. The proposed technique does not choose path with battery powered node even though the hop count and delay are less.

IV. RESULT AND DISCUSSIONS

In the network scenario as shown in figure 4, S is the source node and D is the destination node and other nodes are intermediate nodes. The node S has 4 different paths to communicate with the node D. The path S-3-D has minimum hop count and having sufficient energy for current transmission, though the proposed work will not choose the path S-3-D as efficient path because the node 3 is battery powered node. The proposed work gives high priority to path having nodes with direct current (DP), and next level priority to path having energy harvesting (HP) nodes and last priority to the battery powered node (BP).

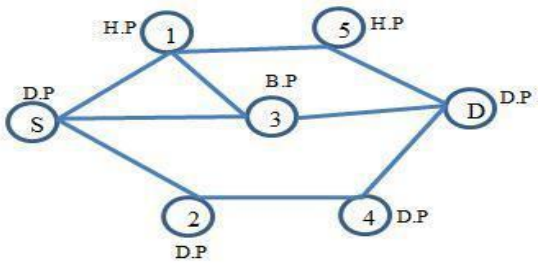

Figure 3. Network Scenario

The energy required for sending the data varies from technology to technology. As shown in table 2, Technology 802.11b requires 36.4mJoules/MB and 802.11g requires 7.4mJoules/MB even though the TX Power for both technologies is 50mW. This energy variation is due to the bit rate of technologies.

Table 2: Energy for Data Transmission

Technology	TX power	Bit rate	Energy
802.11b	50mW	11Mb	0.0364 J\MB
802.11g	50mW	54 Mb	0.0074 J\MB
802.11a	200mW	54 Mb	0.0296 J\MB
802.15.1	1mW	1 Mb	0.008 J\MB
802.15.3	200uW	55 Mb	0.00003 J\MB

V. CONCLUSION

The applications of IoT enable human beings to live a luxuries life. The automation of college management provides an efficient way to enhance the administration. The proposed automation of college management system uses the enhanced routing technique to select the path. The proposed technique provides the Qos in routing by choosing the path with direct current energy nodes. Thus, the life time of network and life time of battery powered nodes are increased. The proposed technique sacrifices a small delay and increases the life time of the network. In future other parameters of QoS will be concentrated to enhance to IoT communication.

REFERENCES

[1] Rongxing Lu, Xu Li, Xiaohui Liang, and Xuemin (Sherman) Shen, "GRS: The Green, Reliability, and Security of Emerging Machine to Machine Communations", Communications Magazine, IEEE, 2011, pp.28-35.

[2] Shyam Sundar Prasad and Chanakya Kumar, "A Green and Reliable Internet of Things", *Communications and Networks*, vol.5, 2013, pp.44-48.

[3] Park, Sang-Hyun, and Jung-Ryun Lee. "The Energy-Efficient Probabilistic Routing in MANETs." *Frontier and Innovation in Future Computing and Communications*. Springer Netherlands, 2014, pp.773-784.

[4] Quercia, Daniele, Rossano Schifanella, and Luca Maria Aiello. "The shortest path to happiness: Recommending beautiful, quiet, and happy routes in the city." *Proceedings of the 25th ACM conference on Hypertext and social media*. ACM, 2014.

[5] Kristianto, Yohanes, et al. "A model of resilient supply chain network design: A two-stage programming with fuzzy shortest path." *Expert Systems with Applications* 41.1, 2014, pp.39-49.

[6] Nanongkai, Danupon. "Distributed approximation algorithms for weighted shortest paths." *Proceedings of the 46th Annual ACM Symposium on Theory of Computing*. ACM, 2014.

[7] Villas, Leandro A., et al. "A spatial correlation aware algorithm to perform efficient data collection in wireless sensor networks." *Ad Hoc Networks* 12, 2014, pp.69-85.

[8] Sundar, Kaarthik, and Sivakumar Rathinam. "Algorithms for routing an unmanned aerial vehicle in the presence of refueling depots." *Automation Science and Engineering, IEEE Transactions on* 11.1, 2014, pp.287-294.

[9] Sun, Qi-Bo, et al. "Internet of Things: Summarize on Concepts, Architecture and Key Technology Problem [J]." *Journal of Beijing University of Posts and Telecommunications* 3.3, 2010, pp.1-9.

[10] Sampath Kumar, B. T., and B. S. Biradar. "Use of ICT in college libraries in Karnataka, India: a survey." *Program* 44.3, 2010, pp. 271- 282.

[11] Hjalager, Anne-Mette. "A review of innovation research in tourism." *Tourism management* 31.1, 2010, pp.1-12.