**Clustering Routing Algorithm for Wireless Sensor Network Based on Mixed Strategy Game The**

**ABSTRACT**

We propose a clustering routing algorithm for wireless sensor networks (WSNs) based on

mixed strategy game theory (CR-MSGT), which simulates the behavior of sensor nodes in a

network through the mixed strategy model, so as to determine whether sensor nodes participate

in the election of candidate cluster heads (CHs). The sensor nodes are randomly selected as CHs

or common nodes according to their residual energy and the average energy of the network.

Games are continuously played between nodes until the revenue function is maximized to reach

the game equilibrium, thus proving the existence of the Nash equilibrium. Experimental results

show that CR-MSGT can effectively extend the survivability of a network and mitigate the

energy consumption of nodes.

**Keywords:** wireless sensor network, mixed strategy game theory, cluster.

**LITERATURE SURVEY**

**P. Chanak and I. Banerjee: IEEE Trans. Consum. Electron. 66 (2020) 22.**

Recently, the Internet of Things (IoT) topology has used to collect physical, physiological, vital signs of patients in consumer-centric e-health or consumer' wellness care services. In such healthcare systems, varieties of medical sensors are attached to the patients to collect vital signs from those who are under observation. The data gathering process in IoT-enabled Wireless Sensor Network (WSN) suffers from the congestion problem. The effect of this translates on missing packets, a decrease of reliability and throughput degradation in IoT-enabled WSN. This article proposes a distributed congestion control algorithm for IoT-enabled WSNs to effectively resolve the congestion for healthcare applications. The proposed scheme alleviates congestion by a priority-based data routing strategy. Furthermore, this article presents a priority queue based scheduling scheme for better reliability. We analyze the properties of the proposed congestion control mechanism mathematically and validate its performance through extensive simulation and real-life experiments. The application of this work can be used to an early warning system in detecting abnormal heart rate, blood pressure, ECG, EMG in the hospital/home care environment to the state-of-art diagnosis.

**Summary:** Studied about Distributed congestion Control algorithm For IOT-enabled WSN .

**2 M. N. M. Bhutta and M. Ahmad: IEEE Access 9 (2021) 65660:**

Food supply chain process comprises crops collection, processing of food, shipping & delivery to the whole seller in the market. Harvested foods decompose from the moment they are harvested due to attacks from enzymes, oxidation, and microorganisms. These include bacteria, mold, yeast, moisture, temperature, and chemical reaction. The spoilage of fresh food has increased over time due to the multistage slow food supply chain process. The identification, traceability, and real-time tracking of goods in supply chains have always been a challenge. The advent of the Internet of Things and cloud computing has brought a new approach to the food supply chain process for better cooperation among supply chain partners. The supply chain management (SCM) benefit greatly through automation based on key technologies of IoT, Radio Frequency Identification (RFID), and Wireless Sensor Networks (WSN). These technologies collect the data relevant to the food supply chain system, such as identifying tag-possessed objects or individuals and sensing capabilities of the surrounding environment. However, the collected data can be tempered or modified by attackers to provide false information about environmental conditions. They can destroy or damage the product due to false identification of dynamic environmental conditions. Furthermore, the current automation systems in industry-based retail logistics and SCM do not provide efficient solutions for monitoring the quality of perishable products with integrated solutions. This research aims to develop a secure monitoring and reporting system based on IoT to update the quality of the perishables along with the SCM with a focus on transportation without any human intervention.

**Summary:** Studied about the Secure Identification, Traceability and Real-Time Tracking of Agricultural Food Supply During Transportation Using Internet of Things.

**3 J. B. Valencia, L. C. Londono, D. M. Viloria, and M. R. Garcia: IEEE Internet Things J. 6 (2018) 3024.**

The rapid growth of Internet-of-Things (IoT) in the current decade has led to the development of a multitude of new access technologies targeted at low-power, wide area networks (LP-WANs). However, this has also created another challenge pertaining to technology selection. This paper reviews the performance of LP-WAN technologies for IoT, including design choices and their implications. We consider Sigfox, LoRaWAN, WavIoT, random phase multiple access (RPMA), narrowband IoT (NB-IoT), as well as LTE-M and assess their performance in terms of signal propagation, coverage and energy conservation. The comparative analyses presented in this paper are based on available data sheets and simulation results. A sensitivity analysis is also conducted to evaluate network performance in response to variations in system design parameters. Results show that each of RPMA, NB-IoT, and LTE-M incurs at least 9 dB additional path loss relative to Sigfox and LoRaWAN. This paper further reveals that with a 10% improvement in receiver sensitivity, NB-IoT 882 MHz and LoRaWAN can increase coverage by up to 398% and 142%, respectively, without adverse effects on the energy requirements. Finally, extreme weather conditions can significantly reduce the active network life of LP-WANs. In particular, the results indicate that operating an IoT device in a temperature of -20 °C can shorten its life by about half; 53% (WavIoT, LoRaWAN, Sigfox, NB-IoT, and RPMA) and 48% in LTE-M compared with environmental temperature of 40 °C.

**Summary:** Studied about Low-Power Wide Area Network Technologies for Internet-of-Things.

**4 S. A. Alavi, K. Mehran, Y. Hao, A. Rahimian, H. Mirsaeedi, and V. Vahidinasab: IEEE Trans. Smart Grid 10(2019)4323:**

This paper presents a complete design, analysis, and performance evaluation of a novel distributed event-triggered control and estimation strategy for dc microgrids. The primary objective of this work is to efficiently stabilize the grid voltage, and to further balance the energy level of the energy storage systems. The locally-installed distributed controllers are utilized to reduce the number of transmitted packets and battery usage of the installed sensors, based on a proposed event-triggered communication scheme. Also, to reduce the network traffic, an optimal observer is employed which utilizes a modified Kalman consensus filter to estimate the state of the dc microgrid via the distributed sensors. Furthermore, in order to effectively provide an intelligent data exchange mechanism for the proposed event-triggered controller, the publish-subscribe communication model is employed to setup a distributed control infrastructure in industrial wireless sensor networks. The performance of the proposed control and estimation strategy is validated via the simulations of a dc microgrid composed of renewable energy sources. The results confirm the appropriateness of the implemented strategy for the optimal utilization of the advanced industrial network architectures in the smart grid.

**Summary:** Studied about a Distributed Event-Triggered Control Strategy for DC Microgrids Based on Publish-Subscribe Model Over Industrial Wireless Sensor Networks.

**5 Q. Li, N. Zhang, M. Cheffena, and X. Shen: IEEE Trans. Wireless Commun. 19 (2020) 696.**

Recent developments in industrial wireless sensor networks (IWSNs) have revolutionized industrial automation systems. However, harsh industrial environment poses great challenges to a time-critical and reliable wireless communication. For instance, effects of multipath fading, noise and co-channel interference can have unpredictable and time-varying impacts on the propagation channel, leading to the failure of on-time packet delivery. To address this problem, in this paper we propose a channel-based Optimal Back-off Delay Control (OBDC) scheme which can minimize the total time a packet spends in the sensor node (TSN) by assessing the features of a generic wireless channel. Specifically, we first explore the channel impairments by investigating the probability density function (PDF) of the level crossing rate (LCR) of the received signal in the industrial wireless environment. Then, with the obtained channel assessment results, we develop a phase-type semi-Markov model to investigate the probability distribution of the back-off delay of a packet in the sensor node (SN). The probability distribution of the back-off delay can be further substituted with TSN according to the queuing theory. The proposed OBDC scheme examines the Kullback-Leibler (KL) divergence between the obtained distribution of TSN and the packet arrival rate, and reduces the TSN according to an objective function which is constantly renewed in every transmission round with regard to a delay constraint. The simulation results show that the OBDC scheme can reduce TSN and guarantee to keep the TSN in an acceptable range even though the wireless channel is impaired by interference effects. It also shows that the OBDC scheme can reduce the proportion of packets meeting their deadline to the total packets in transmission when the number of SN and LCR changes.

**SUMMARY:** Studied about Channel-Based Optimal Back-Off Delay Control in Delay-Constrained Industrial WSNs.

**CHAPTER 3**

**EXISTING METHOD**

The low-energy adaptive clustering hierarchy (LEACH) algorithm and the distributed energy efficient clustering (DEEC) algorithm are two traditional sub-clustering routing algorithms.(6,7) In the LEACH algorithm, each node randomly generates a number between 0 and 1 to determine whether the node acts as the CH. Owing to the stochastic nature of this value, there may be an excessively large number of clusters during selection in each round and an uneven distribution of CHs in the network. The DEEC algorithm considers the residual energy of the node itself during the selection of the CHs, making the nodes with higher energy more likely to become CHs. However, because the distribution of CHs is disordered, some CHs may be distributed in the network edge zone, resulting in CH nodes consuming more energy for data transmission.

**CHAPTER 4**

**PROPOSED METHOD**

A wireless sensor network (WSN) has sensor nodes, which can perceive a certain range of environmental information, as the basic unit. In recent years, with the rapid adoption of the Internet of Things, the range of applications of WSNs has become increasingly extensive and now includes smart medical care,(1) smart transportation,(2) modern agriculture,(3) and warehouse management.(4,5) For a WSN, the survival status of nodes affects the information perception ability of the entire network and determines the operating life of the network. Sensor nodes are usually driven by a limited amount of power, and their ability to calculate, store, and transmit data is also limited. Because of the large number of sensor nodes in most networks, battery replacement is generally unfeasible, so reducing node energy consumption and extending the network life are important research directions. Cluster routing is an effective technology to solve the above problems, where the core idea is to divide the network into multiple clusters with each cluster having a node called the cluster head (CH). The task of communicating with the base station (BS) is completed by the CH node. The nodes in the network take turns acting as the CH. The CH integrates the information. collected by other nodes in the cluster, then forwards the information to the BS via a multi-hop or direct communication mode. The clustering mechanism can reduce the amount of forwarding data and shorten the data transmission distance of most nodes. However, the node acting as the CH consumes more energy than the other nodes in the cluster. Our task is to select the most suitable node in the network to act as the CH through game theory, which can balance the node load and energy. Game theory provides a decision-making environment model that is interdependent and may exchange roles. In this paper, a clustering routing algorithm for a WSN based on mixed strategy game theory (CR-MSGT) is proposed.

**CHAPTER 5**

**ADVANTAGES AND APPLICATIONS**

**Advantages:**

* This method reduces the number of forwarding packets and extends the network life by collecting energy from the network.
* Easy to implement and easy to understand

**Applications:**

1.industrial control

2.environmental monitoring,

3. military surveillance,

4.intelligent transportation systems and medical field.

5.Furthermore, it can function independently in harsh or high-risk places where human presence is not possible

6.Disaster relief operations.

7.Biodiversity mapping

8.monitoring of temperature, pressure, and humidity

**Software & Hardware Requirements:**

**Software:** Matlab 2020a or above

**Hardware:**

**Operating Systems:**

* Windows 10
* Windows 7 Service Pack 1
* Windows Server 2019
* Windows Server 2016

**Processors:**

Minimum: Any Intel or AMD x86-64 processor

Recommended: Any Intel or AMD x86-64 processor with four logical cores and AVX2 instruction set support

**Disk:**

Minimum: 2.9 GB of HDD space for MATLAB only, 5-8 GB for a typical installation

Recommended: An SSD is recommended A full installation of all MathWorks products may take up to 29 GB of disk space

**RAM:**

Minimum: 4 GB

Recommended: 8 GB

**Learning outcomes:**

* Introduction to Matlab
* What is EISPACK & LINPACK
* How to start with MATLAB
* About Matlab language
* Matlab coding skills
* About tools & libraries
* Application Program Interface in Matlab
* About Matlab desktop
* How to use Matlab editor to create M-Files
* Features of Matlab
* Basics on Matlab
* What is an Image/pixel?
* About image formats
* Introduction to Image Processing
* How digital image is formed
* Importing the image via image acquisition tools
* Analyzing and manipulation of image.
* Phases of image processing:
* Acquisition
* Image enhancement
* Image restoration
* Color image processing
* Image compression
* Morphological processing
* Segmentation etc.,
* How to extend our work to another real time applications
* Project development Skills
  + Problem analyzing skills
  + Problem solving skills
  + Creativity and imaginary skills
  + Programming skills
  + Deployment
  + Testing skills
  + Debugging skills
  + Project presentation skills
  + Thesis writing skills