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Smart ECG Data Queuing Mechanism for QoS Enabled Healthcare Networks

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ABSTRACT

The proposed technique has been found efficient on all of the total arrival rate events, which is clearly visible from the proposed technique performance at 1.04 seconds against 1.08 seconds (PWRR-MD), 1.15 seconds (PWRR-AV), 1.17 seconds (PWRR-nMD) and 1.2 seconds (FIFO) on the event rate of 0.2, which is repeated on all of the total arrival rate events. The minimum response delay of 1.04 seconds has been recorded for the proposed Technique against the 1.2 seconds (FIFO), 1.17 seconds (PWRR-nMD), 1.216 seconds (PWRR-AV) and 1.1498 seconds (PWRR-MD), which shows the efficiency of the proposed technique in delivering the healthcare data over the internet. This clearly shows that the proposed technique has been found efficient in delivering the categorized healthcare data as critical, super critical and normal updates, which plays the vital role in saving the patient's life during the critical situations.

Keywords—Data prioritization, Healthcare networks, Categorical aggregation, Smart queuing.

I. INTRODUCTION

The healthcare networks are growing over the past decade and found applications in the rural and urban health, and has helped NGOs and other welfare organizations for the healthcare of the tribal and other people living in the remote areas. The wireless healthcare networks are popularly known as the wireless body area networks (WBAN), and are mostly based upon the GSM networks, CDMA networks, Wi-Fi, Wi-Max or Zigbee networks for data propagation between the client nodes and the centralized storage infrastructures. The wireless networks are considered as the internet of things (IoT) networks, as there is the use of smaller wireless sensor based networks for the healthcare monitoring and alarm generation under the critical conditions. The healthcare wireless networks (also known as healthcare IoT) are prone to the various data propagation issues, which must be curbed in order to facilitate the efficient data delivery mechanism for the smooth data flows across the healthcare IoT networks. This technique has been designed for the efficient delivery of the healthcare data between the sensor nodes and central storage and monitoring server.

II. LITERATURE REVIEW

[2015] Xiang, Chaocan et. al. [1] has taken a shot at the QoS-based administration choice with lightweight depiction for huge scale benefit arranged IoTs. The creators have tended to these difficulties with the accompanying three essential thoughts. Right off the bat, the creators have displayed the lightweight depiction technique to portray the QoS, drastically diminishing the time intricacy of administration determination. Additionally, in light of this QoS portrayal, they have deteriorated the mind boggling issue of QoS-based

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administration choice into a basic and fundamental sub-issue. At last, in view of this issue disintegration, they have additionally introduced the QoS-based administration coordinating calculation, which significantly enhances choice precision by considering the entire importance of the predicates. [2014] Kumar, Adarsh et. al. [8] has worked upon recreation and examination of authentication protocols for mobile Internet of Things (MIoT). In this work we discuss a solitary bar round topology based authentication protocol for MIoT. This tecnique helps in confirming the mobile devices for developing secure system. In this protocol is demonstrated utilizing Alloy display. Further, Zone Routing Protocol (ZRP) is thought to be the best protocol for developing a safe system. [2014] Lee, Jun-Ya et. al. [2] has proposed a lightweight authentication protocol for internet of things. In this paper, the creators have discussed an encryption technique in view of XOR control, rather than complex encryption, for example, utilizing the hash work, for hostile to forging and security assurance. The improvement of the security is portrayed and equipment outline system is likewise illustrated.

III. EXPERIMENTAL DESIGN

This technique is based upon the quality of service (QoS) for the prioritization of the data according to the criticality, which classifies the data into the three main classes, normal, moderate and critical. The data propagation technique evaluates the ECG signal being received from the sensor node originating the ECG data from the patient's body and computes the heartbeat rate (HBR) by processing the received ECG signal with QRS-peak analytical technique. The moderate and critical data is sent towards the centralized storage and monitoring system in the unicast mode, whereas all of the normal updates are aggregated and forwarded as the one packet for the bandwidth preservation. The performance of the proposed technique has been tested over the cellular and WiFi networks during the peak and lower bandwidth availability times. In this work we have been found efficient and balanced in both of the conditions, where the total delay has been recorded slightly lower in the busy period than the low availability periods over both of the networks. This technique has been successful for the efficient delivery of the healthcare data across the WBANs by using the smart propagation mechanisms based upon the weighted QoS, which can be applied over the dense scenarios to maximum the bandwidth utilization to increase the data of the multiple patients over the given network segment.

Algorithm 1: Healthcare Data Prioritization Algorithm

1. Input the ECG data files for random generation of patient data
2. Set the number of patients in the simulation
3. Set the lower beat rate upper bound threshold (lowBeatUB)
4. Set the lower beat rate lower bound threshold (lowBeatLB)
5. Set the higher beat rate threshold upper bound (highBeatUB)
6. Set the higher beat rate threshold lower bound (highBeatLB)
7. Initialize the sensor nodes in the simulation
8. Produce the data on the sensor nodes using the random ECG sequence generator over the Physionet data
9. Connect the BTS node with client nodes (patient nodes)
10. Patient nodes transmit the ECG data towards the BTS node
11. BTS node evaluates the level of criticality by analyzing the ECG data of each patient in the simulation

a. Mark the patient ID with super critical level, if the following equation matches

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i. $\begin{cases} If\ beatRate > highBeatUB, & Predict\ Super\ Critical \\ If\ beatRate < lowBeatUB, & Predict\ Super\ Critical \end{cases}$

ii. $\begin{cases} If\ highBeatLB < beatRate < highBeatUB, & Predict\ Critical \\ If\ lowBeatLB < beatRate < lowBeatUB, & Predict\ Critical \end{cases}$

iii. And predict the patient as normal otherwise

12. Set the criticality pattern for each node using the following patterns

a. Super critical health of the patient is indicated with two bit sequence of [1 1]

b. Critical health of the patient is indicated with two bit sequence of [1 0]

c. Normal health of the patient is indicated with two bit sequence of [0 0]

13. Transmit the data from the BTS to cloud based healthcare server for different criticality levels

a. Transmit the data of critical and super critical patients through the unicast packets to ensure the quickest delivery, and forward the data towards the cloud based healthcare server

b. Aggregate the data of normal patients, and forward the data towards the cloud based healthcare server

14. Return the simulation

IV. RESULT ANALYSIS

The QoS based data criticality analysis (QDCA) technique has been designed to create the efficient process of healthcare data prioritization using the heart beat analysis over the base station nodes. This technique has been compared against the existing priority weighted round robin (PWRR) technique on the basis of the response delay, which is the critical aim of the proposed technique under this research. This technique has been found efficient than the existing techniques on nearly all of the intervals as per shown in the following table (Table 5.2.1)

Table 5.2.1: PWRR vs Proposed QDCA technique on the basis of response delay

Total Arrival Rate	PWRR (MD)	PWRR (AV)	PWRR (nMD)	FIFO	PROPOSED
0.2	1.08	1.15	1.17	1.2	1.04
0.25	1.11	1.16	1.19	1.27	1.07
0.3	1.12	1.17	1.24	1.32	1.1
0.35	1.14	1.18	1.31	1.38	1.13
0.4	1.15	1.19	1.39	1.44	1.134
0.45	1.16	1.21	1.44	1.50	1.14
0.5	1.17	1.23	1.57	1.56	1.143
0.55	1.18	1.27	1.69	1.62	1.144
0.6	1.19	1.29	1.83	1.68	1.15
0.65	1.198	1.31	2.13	1.74	1.16

The comparative analysis focuses upon the base rate in the form of total arrival rate, and the response delay has been recorded on all of the events defined under the total arrival rate series. This technique has been found

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consistently lower than the FIFO and PWRR techniques, which shows the robustness of the technique in delivering the healthcare data.

Table 5.2.2: PWRR vs Proposed QDCA technique on the basis of average, minimum and maximum response delay

	Delay		
Scheme	**Average**	**Minimum**	**Maximum**
PWRR (MD)	1.1498	1.08	1.198
PWRR (AV)	1.216	1.15	1.31
PWRR (nMD)	1.496	1.17	2.13
FIFO	1.473333	1.2	1.743333
PROPOSED	1.1211	1.04	1.16

In the above table (Table 5.2.2.) shows the average, minimum and maximum values of the PWRR, FIFO and PROPOSED techniques over the data series obtained in the table 5.2.1. This technique has been found lower than the existing techniques in all of averaging factors (average, minimum and maximum).

V. CONCLUSION

This technique has been recorded with the average delay 1.1211 seconds against the value obtained for various existing techniques, which includes 1.11498 seconds (PWRR-MD), 1.216 seconds (PWRR-AV), 1.496 seconds (PWRR-nMD) and 1.473 seconds (FIFO). This technique has been found at 1.16 seconds of maximum delay against the 1.198 seconds (PWRR-MD), 1.31 seconds (PWRR-AV), 2.13 seconds (PWRR-nMD) and 1.743 seconds (FIFO), which shows the efficiency of the technique in delivering the healthcare data according to urgency computed over heart beat rate.

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