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ENHANCING DATA RELIABILITY USING RANKING OF SENSOR NODES IN WSN-MCC INTEGRATION

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Abstract- Integrated applications of Wireless Sensor Network (WSN) and Mobile Cloud Computing (MCC) are widely used in various sectors. In WSN-MCC integrated applications, User requests the data to Mobile Cloud Computing through smart phones and that request send to the wireless sensor network via mobile cloud computing. Then WSNs sense the data based on the user request. After processing the data, the sensed data sent to the user through MCC. The obtained reliable data are very useful to the mobile user in order to support the WSN-MCC integrated applications. This work represents critical issues, which is considerably affecting reliability of sensory data. To overcome this issue, a new method RTPSS (Ranking with Time and Priority based Sleep Scheduling) is proposed. It consists of two parts: (i) based on the time and priority features of the user request, WSN gateway selectively transmit the sensory data (ii) to save the energy consumption of sensor nodes. Ranking the sensor nodes based on priority of the user request and usage of applications which is used to most reliably transmit the data from the WSN to MCC. The result of RTPSS is used to improve the reliability of the sensory data in WSN-MCC integration.

Keywords—Reliability, Ranking with Time and Priority based Sleep Scheduling (RTPSS), integration, user request.

I. INTRODUCTION

Wireless sensor networks (WSNs) are geographically dispersed independent sensors that agreeably screen some physical or natural conditions (e.g., temperature, sound, vibration, weight, movement, and so on.). WSNs have pulled in the consideration of various scientists as a result of their incredible potential to empower numerous essential applications (e.g., war zone observation, fight harm appraisal, mechanical process checking and control, wellbeing observing, home computerization, also, activity checking), which could change the way that individuals communicate with the physical world. In wellbeing observing, by conveying sensor hubs to screen and identify the body status (e.g., heart rate, a fall, and so forth.) of elderly individuals or patients, specialists can distinguish manifestations or forestall startling mishaps prior without direct contacts with the subjects. In advances micro electromechanical frameworks and computerized gadgets, and additionally remote interchanges, which make small scale, ease, low-control, and multifunctional sensor hubs accessible, across the board execution of WSNs are turning into a reality.

Additionally, with accessible less expensive, all the more capable and omnipresent processing assets, cloud computing (CC) has risen as another processing model. In CC, assets (e.g., processors, stockpiling, systems, applications, and administrations) are offered as general utilities that can be quickly provisioned and discharged by clients through the Internet in an on-interest way. It offers the accompanying points of interest to the client of registering administrations: 1) no in advance venture; 2) lower working expense; 3) high versatility; 4) simple availability; 5) lessened business dangers and support costs. Acquiring the upsides of CC, mobile CC (MCC) further conquers as far as possible (e.g., battery, stockpiling limit, what's more, handling force) of cell phones by offloading a great part of the information handling and capacity from the cell phone to the effective processing stages situated in the mists. In expansion, MCC additionally influences the uses of CC to empower a ton of new portable administrations (e.g., versatile cloud trade, versatile cloud learning, portable cloud social insurance, and versatile cloud gaming) with CC. With the cloud putting away information and preparing customer solicitations from brilliant telephones sent by means of remote systems, much wealthier administrations, also as speedier preparing velocity, could be given through MCC to both learners and educators. In portable gaming, MCC could move the amusement motor that requires extensive processing assets (e.g., for realistic rendering) to the servers in the cloud. At that point, diversion players just need to communicate with the screen interface on their gadgets. This not just can diminish vitality utilization for cell phones. Additionally, it can improve the execution (e.g., revive rate, picture definition, and sound impact) of portable gaming.

As of late, prompted by the engaging qualities of both the universal information gathering capacity of WSNs and the effective information stockpiling and preparing limits of MCC, the joining of WSNs and MCC has pulled in much consideration from both the educated community and industry. The fundamental thought is to use the intense CC stage to store and process the tangible information (e.g., moistness, temperature, and movement) and afterward advance offer these handled tangible information to the portable clients. For instance, WSNs are sent to gather the climate, mugginess, temperature, movement, and house data inside of a certain zone. The gathered data can be transmitted to the cloud for capacity and handling first. At that point, the cloud is ready to advance transmit the prepared tactile information to the versatile clients on interest. Portable clients can have admittance to the tangible data with only a straightforward customer in the cell phone.

II. RELATED WORK

In latent applications of integrated WSN-MCC (e.g., ubiquitous healthcare monitoring, environmental monitoring for disaster detection, agriculture and irrigation control, earth observation, transportation and vehicle real-time visualization, tunnel monitoring, wildlife monitoring) [21], relative number of them essentially need the WSN to reliably suggest sensory data that are more beneficial to the cloud based on the requests of the mobile users. In smart house observing as an event, although various observed information around the entire house collected by the tactically deployed video sensors, image sensors and other types of sensors can be used to let the owner of the house or other authentic and legitimate people conveniently gather their preferred data with the mobile devices (e.g., smart phones, tablet computers), it is expected that videos from various places (e.g., storage room) are of tiny importance, while videos from other areas (e.g., front door, back door, windows) are considered to be more significant to make sure that there is no unpredicted interruption into the house. Hence, not all the sensory data are beneficial (i.e., actually used) to fulfill user needs in the cloud, though transferring these data (i.e., multimedia data) to the cloud will use considerable network bandwidth. From this point, observe that sensory data that are more valuable to the mobile users should be obtainable from WSN to cloud. On the other hand, to accomplish the goal of observing the house wisely, the WSN desires to effectively collect and transfer the composed information (e.g., videos, images) to the cloud endlessly, which means the sensory data should be reliably accessible from the WSN to the cloud.

In WSN-MCC integration, reliability of WSN is related to gather and transmit ability of sensory data to the cloud in successful manner. We observe the subsequent vital problems regarding the reliability of WSN.

CONSUMPTION OF SENSING ELEMENT ENERGY

Generally, sensors can consume their restricted battery power by performing sensing, processing and transferring data, later certain period of time, as they are typically equipped with not rechargeable and replaceable batteries. Significantly, the sensors close to the gateway area unit forward more packets via mediator nodes to the gateway on behalf of the source nodes. thus they will consume their energy earlier than other sensors and form holes in the WSN where no data is collected for the cloud and WSN to be disconnected.

SENSORY DATA TRANSMISSION FAILURES

The data transmissions from one sensor to different sensing elements and from the WSN to the cloud might encounter failures or losses, because of numerous factors like network congestion, bandwidth limitation or interference [4]. In such situation, if the WSN does not perform data retransmission, then the cloud could not get the sensory data comes from the WSN.

LIMIT IN STORAGE SPACE FOR SENSORY DATA

As declared in [10], data storage could be a terribly serious issue for WSN, since an oversized volume of collected data must be archived for future data retrieval. Additionally, when sensors are deployed to collect multimedia information like pictures or videos that typically have massive sizes, this aggravates the demand on sensory information space for storing. If the sensors do not have obtainable space to store the detected information, then the cloud cannot acquire any sensory information, though the sensors have high enduring energy to collect and transfer information and therefore the data transmissions from WSN to cloud are prospering. It paper assume that sensors have sufficient space for storing and do not think about the sensory information transmission failure. The sensor energy consumption issue, that powerfully affects the reliability of a WSN. Proposed scheme mainly focused to be solving the sensory data transmission failures.

III. PROPOSED WORK

A. Proposed WSN-MCC integration

The WSN-MCC integration system is modeled and analyzed based on the subsequent assumptions.1) The integration system has one cloud C and MU mobile users (i.e., MU = $(mu_1\ mu_2, \ldots, mu_N)$) in addition, several WSNs (i.e., W = $(w_1, w_2, \ldots, w_M)$. Every WSN gathers and transmits information to the cloud to satisfy the data requests from every corresponding mobile user. 2) Every WSN consists of one gateway GW likewise M sensor nodes (i.e., I = $(i_1, i_2, \ldots, i_M)$). 3) Every gateway GW is outwardly powered with a limitless energy supply. Every sensor node " i " features a restricted energy supply powered by a non-rechargeable and non-replaceable battery, that has an initial energy "$ener_0$" and a residual energy "$ener_i$". 4) Time is split into S time sessions (i.e., T= $(t_1, t_2, \ldots, t_s)$).

B. System Architecture

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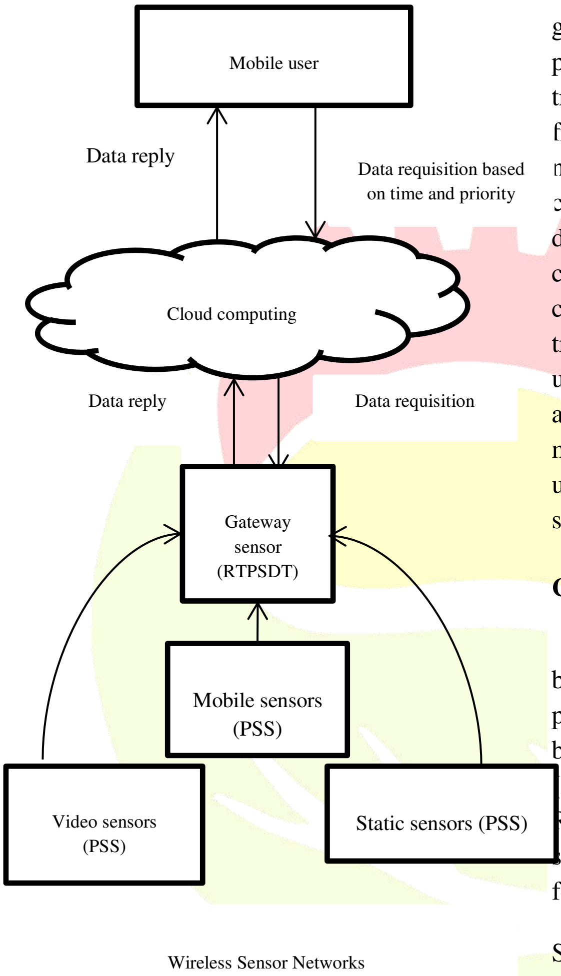

Figure 1 Proposed WSN-MCC integration with RTPSS scheme

The proposed RTPSS scheme is shown in Fig.1 is to collect and transmit sensory information for WSN-MCC integration, RTPSS scheme reliably offer information that are more useful to the mobile users from WSN to cloud. RTPSS scheme steps for each WSN to collect and transmit sensory information for every corresponding mobile user. PSS used for sensor nodes determine their awake and asleep states. Awaken state sensor nodes sense the geographical information, store the sensory information and also process the sensory information. The processed sensory data send the information to the gateway with hop by hop and many to one pattern. The received sensory data stored in gateway and then processes the sensory data. RTPSDT scheme rankwise transmit the data from gateway node to cloud and sensor nodes to gateway node. Cloud C additionally stores and processes the received sensory data. Until the data transmission is successful, the data transmitted from sensor nodes to gateway node or gateway node to Cloud. Mobile user, request the data to cloud and cloud transfer the requested sensory data to the mobile user. If data transmission from cloud to mobile user meets data losses or failures, cloud performs data retransmission until the data transmission is successful. Cloud dynamically updates the NTP table with equation (1) if the time and priority features of the requested data of the mobile user. Calculate ranks and sends the changed updated NTP table to gateway in every time session t.

C. RTPSS scheme

RTPSS (Rank with Time and Priority based Sleep Scheduling) scheme consists of two parts. (i) RTPSDT (Ranking with Time and Priority based Selective Data Transmission), (ii) PSS (Priority based Sleep Scheduling). The process of RTPSDT for every WSN gateway node to selectively transmit data to the cloud. Algorithm for RTPSDT scheme whose steps are given below,

STEP 1: Every gateway set timer that records the current time value.
STEP 2: For every time session, gateway obtains NTP table.
STEP 3: Also gets the current residual energy for sensor nodes.
STEP 4: Calculate the probability value for sensor nodes,

$$p_i^t = r_i^t / R^t \qquad (1)$$

p_i^t - probability of sensor node " i " for each time period t.
r_i^t - request history of node " i " for particular period t.
R^t – request history to all sensor nodes for specified time period.

STEP 5: Calculate ranks based on the probability value.
STEP 6: Go to sleep state when sensor nodes energy get reduced.

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i. RTPSDT

In our proposed RTPSS, the gateway selectively transmits the data rank wise manner to the cloud. This design is to enhance the reliability of data, since RTPSDT data transmission is based on the NTP table deduced from usage, time and priority features of data requested by mobile user. They requests the data that not stored in the Cloud at time period t. NTP table is dynamically updated with (i) Ranking that based on Time and priority features of the requested data, (ii) Sensor nodes residual energy, (iii) If error occurs, retransmit data until data transfer is successful. RTPSDT scheme reliably transmit the data from WSN to cloud.

Table 1 Example of Nodes vs. Time and Priority (NTP)

Ranking of Sensors	Points of Interest	9AM - 10AM	10AM – 11AM	11AM – 12PM	12PM – 1PM
r_2	i_1	10%	5%	20%	15%
r_4	i_2	20%	5%	0%	15%
r_3	i_3	20%	10%	0%	15%
r_1	i_4	20%	20%	30%	15%

ii. PSS

Priority based Sleep Scheduling (PSS) is used to detect the awake and asleep state sensor nodes. The nodes of interest in NTP table with probability larger than 0% should be awaken in every time period t. Sleep Schedule network should be connected at all time, so that transmission of data from sensor nodes to gateway can be performed. To reduce energy consumption, in each time period t, only a subset of all sensor nodes should be awaken. Awaken state nodes generally having more residual energy than the nodes that are scheduled to be asleep. PSS scheme reduce the energy consumption of sensor nodes. That's increase the network lifetime.

IV. EVALUATION RESULTS

Assume an environment with 45 to 60 sensor nodes and measure the located sensor nodes, packet delivery rate, average delay, throughput, energy consumption of sensor nodes that will increase the reliability of WSN compared between TPSS and RTPSS scheme.

i. Packet Delivery rate

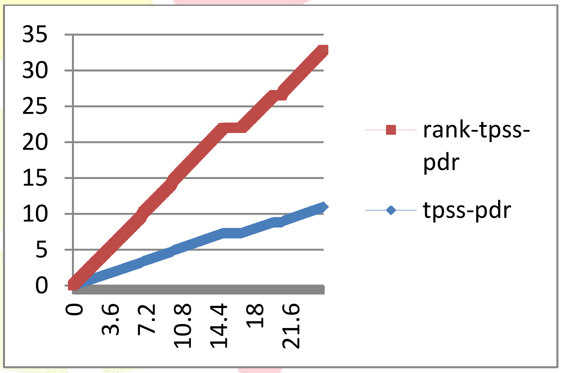

Figure 2 Comparison of packet delivery ratio in RTPSS with existing scheme

Figure 2 shows the analysis result with respect to reliability of data transmission of WSN for each mobile user. X-axis represents time period values in seconds and Y-axis represents values in data bits. The ratio represents number of delivered data packets from WSN to cloud and cloud to mobile user.

ii. Energy Consumption

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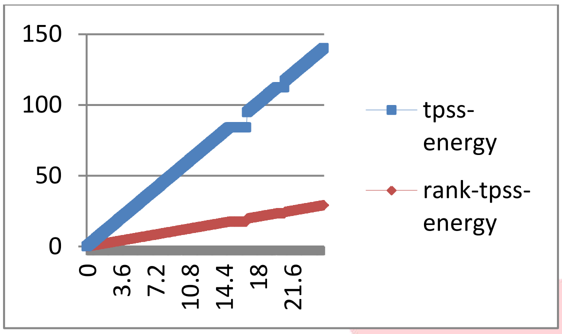

Figure 3 Comparison of energy consumption in RTPSS with existing scheme

Higher energy depletion of sensor nodes leads to disconnect the WSN. It will heavily affect the reliability of WSN. PSS scheme will use higher energy nodes for transmitting data. Hence energy consumption will be optimized. It will increase the lifetime of sensor nodes.

iii. Delay

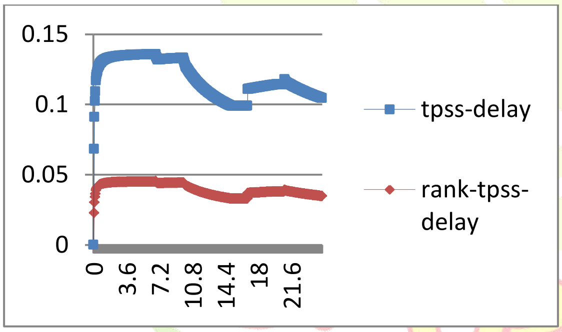

Figure 4 Comparison of delay ratio in RTPSS with existing scheme

Figure 4 shows the average time taken by the data packet to arrive the cloud or mobile user. Delay also includes the delay caused by destination (Cloud or mobile user) discovery process and the queue in data transmission. It should be minimized in the proposed system.

V.CONCLUSION

WSN-MCC integration is a well-timed and significant research topic. The reliability of data processing is based on sensory data and energy consumption of WSN. In this paper, we have proposed a RTPSS scheme to reliably transmit the data from WSN to mobile cloud and mobile cloud to mobile user. Proposed system consists of, 1) RTPSDT scheme, 2) PSS scheme. RTPSDT scheme ranking the sensor nodes based on the usage of applications, time and priority wise manner which is used to transmit the data more reliable. PSS scheme of sensor nodes in WSN, use the sensor energy efficiently and optimize manner. As a result of RTPSS scheme, the network lifetime increases.

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