Torrent Based Byte Streaming with Scheduling in WSN

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Abstract *— In Wireless sensing element Network era, serial communication happens. Serial data transmission speed is very low. The buffer size is also not sufficient. Due to this limitation of buffer, physical parameters like temperature, pressure, humidity and similar can only be sensed and transmitted. The size of 10 to 12 bytes can be transmitted in sensor network. WSN is not made for handling bulky data transmission. However, these sensors can be used for transmitting voice and video if one manages to compress and transmit the image and video content. In addition, the transmission strategy should be such that each bit should reach successfully to destination. Buffer size limitation can be removed if cooperative neighbour is placed and their buffers are added to create large buffer. This paper analysis is concentrated on strategies to build rapid info delivery mechanism and use it to transmit voice, video, and that too without using too costly devices.*

Keywords — *Torrent, TDMA, Image Compression, Video Compression.*

I. INTRODUCTION

The WSN network is used for communication data from one end to another. Therefore, the bytes get transferred. Byte transfer is a non-reliable process. Sometimes the bytes are properly transferred and other time the buffer may get overflows. This may cause incomplete transfer of data or sometimes it may cause long pause of transmission. These types of scenarios occur randomly. Since it is completely unreliable, it can be possible to make it reliable. For that one should use proper handshaking, scheduling and each byte should be monitored and tracked. [1] It is mandatory to adopt and remain firm to certain architecture until the whole transmission do not over. In short, proper synchronization should be maintained. Bytes should reach before a certain time frame. Beyond that time frame , bytes should not get accepted.

II. ABOUT WSN

WSN is a scalable network and contain hundreds of nodes. Scalability should be taken into consideration. These nodes are randomly deployed. These nodes have hardware constraints. They have energy constraint. To relay message, they must discover others and then start relay of messages up to destination node. The scheduling of message transmission is very important here. Otherwise, collision of message may happen. The route discovery and route reservation aspect is also very important. Nodes have communication and computation capabilities. These nodes can sense phenomena and relay it up to destination where we can observe phenomena at remote place. Not only this, one can observe as well as respond back. If we think in term of scale, the protocols of WSN should be such that, these can accommodate the large scale of nodes. Data flowing rate cannot be kept high as it can be kept in cellular network. In WSN, queries get generated to fetch data. Data is gathered from multiple nodes. Single node cannot provide whole data. WSN is not node centric. WSN is data centric. Collection of nodes provides the requested data. In WSN, the nodes are stationary. Using sensor nodes, we can measure pressure, temperature, sound, humidity. We can also measure blood pressure change; heartbeats change and stress.

III. PROBLEM UNDER CONSIDERATION

The WSN can be used for handling 10-12 bytes of data. But what if it can be used for transmitting images, video and audio. How this can be made possible to compress the entity and then transmit the entity. So, compression approach comes first. There are various ways to compress the images, video and audio for MANAT. But, taking into consideration the limits of WSN sensor nodes, we cannot use more memory consuming technics. In the similar manners, there are various technics to do transmission and receiving the signals. These technics are made for MANTS and cannot be straight forward applied for WSN. Therefore, the challenge is how MANET like image compression, video compression, audio compression and bytes transmission can be achieved in WSN, considering the memory constraint, data rate constraint and scalability constraint.

IV. LITERATURE REVIEW

The WSN nodes have various constraints and it faces various issues. WSN nodes must have long life

because in some scenarios, it is impractical to recharge the nodes battery. The transmission or processing should be such that, it should use minimal power and save the power. Node is mostly stationary and they transmit. The signals start weakening soon as the other nodes signals interfere. Range of radio signals should be enough so that it should reach up to the next node and the next node should be in line of sight. There should be stable algorithm to do discovery and multi hopping. The communication is most expensive source of energy consumption. One can switch the radio on and off by using the MAC layer protocols.

Since MAC layer can switch radio on or off, it can also avoid collision of packets. Packets travel back and forth on certain channel using certain frequency. It is the frequency using which node transmits the packets. If receiver is receiving more than one packet at a time, we call it as collision. Due to collision, sender must do retransmission. If collision increases, retransmission also increases. If sender node send packet and receiver does not receive the packet, it is said that sender is over emitting the packet. If receiver is waiting but sender is not sending, it causes energy consumption of receiver since receiver is doing ideal receiving. If receiver receive packet, which is not intended for him, it is said that receiver is overhearing. If less useful packets flow through the network, it causes overhead of packet flow. If no one is sending the packet, the should go to sleep mode to save the energy consumption.

If nodes are added to the network, node density increases size of network increases and topology changes. Routes are changed. Node schedules also are changed. Nodes should be capable to adapt these changes. The algorithm takes some time for calculation. Once the algorithm finish processing and resultant bytes become ready, mac layer protocol software and hardware should respond immediately. Node should respond with minimum latency or delay and it should have high throughput. If packets are large than the channel capacity, with which data that can be passed on channel, then it causes blocking of channel. Whole packet is wasted.

The noisy-channel coding theorem specifies that for any $\varepsilon > 0$ and for any transmission rate R and channel capacity C, R is should be less than C. There should be encoding and decoding scheme for transmitting data at a transmission rate R. The error probability is less than ε, for a sufficiently large block length. Also, for any rate greater than the channel capacity, the probability of error at the receiver will go to one as the block length goes to infinity.

$$C = B \log_2 (1 + (S/N))$$

C is measured in bits per second if the logarithm is taken in base 2. C is measured in nats per second if the natural logarithm is used. B is bandwidth of signal in hertz and S/N is signal to noise ratio. Noise powers S and N are measured in watts or volts. The signal-to-noise ratio is expressed as a power ratio, not in decibels (dB). If 60 db is power ratio, then 10 (60/10) = 10 6 = 1000000 value will be used in above formula.

Message must be less that maximum transmission limit (MTU). Therefore, message must be sub divided and then only it should be transmitted. After subdividing the messages in smaller packets, though rounds of transmissions increases, but the reliability and throughput increases. Throughput or network throughput is the rate of message delivery. The data these messages belong to may be delivered over a physical or logical link or it can pass through a certain network node. Throughput is usually measured in bits per second and sometimes in data packets per second or data packets per time slot. The aim of transmission strategy is 100% successful transmission of each byte. If a compressed file must be transmitted and single, byte is not successfully delivered, it may cause whole file useless and then retransmission attempt will get increased.

If nodes are in densely populated area, these nodes will face large contention. Some noes are situated near the sink and some nodes are situated away from the sink. The nearer nodes transmit frequently to the sink node than the away nodes. Usually due to change in topology, node is not aware of the other nodes, which are three hops or more than three hops away.

V. Proposed Approach

The WSN have memory constraint. However, collection of sensor nodes can form virtually enough memory. These nodes have some configuration of memory. Consider a group of 6 nodes (Assumed even number of nodes) where each node contributes its memory portion. That memory portion is utilized for caching result of processing of compression or transmission. How much amount of memory gets consumed in compression? It depends on the size of image to be compressed. For size of 120x120 pixels image, if we do Fast Fourier Transformation, it takes around 0.50-second time and 500 kb memory to process the compression of 25 colour images. Here python language is considered as Software platform and Raspberry pi is considered as hardware platform having 1 GB RAM and a CPU: 900 MHz quad-core ARM Cortex A7 (ARMv7 instruction set) GPU: Broadcom Video Core IV @ 250 MHz processor. For achieving the byte wise receivable of image bytes, following approach is helpful. For the reliability, the receiver should be questioned about how many bytes' receiver has received. The receiver should get the expected amount of number of bytes. If the receiver does not receive expected number of bytes, it will inform sender that he has received n

bytes. Sender will be responsible to calculate how much byte difference is there.

The byte difference occurs due to the non-reliable transmission or overflow and interferes. So, the retransmission of the difference is the responsibility of sender. In addition, a checksum is to be maintained at both sender and receiver side. [2] Both verify checksum after receiving the required number of bytes. Each transmission session is consisting of a target of number of bytes. Each target is divided into small targets. Each small target is used and transmission is started. But after every transmission, the sender questions the receiver about how many bytes he has received. Receiver replies the length of buffer. The sender receives the length of buffer. So then, the difference is calculated. The difference bytes are sent. The receiver is questioned about how many bytes are received. [3] After confirmation that small target bytes are received, the sender assures and mark completion of small target. After that another small target is chosen and above complete process is repeated till the end of File.

VI. Method

The WSN have memory constraint. But collection of sensor nodes can form virtually a large buffer. The multimedia content delivery process is completely dependent on how many bytes are to be transmitted. The number of bytes if larger than a specific limit, the transmission attempts will increase. It will cause more retransmission. The content should not be more. Content should be kept as minimum as possible. The only way is to encode the images and keep the length of encoding as minimum as possible. [4] The encoding strategy should have an 8x8 pixels representation and for each block of 8x8 pixels, there should either a formula for an encoded string. Block information should get logged in file. This file is saved and zipped inside a folder. For successive frames, one should encode the difference in form of matrix. The difference matrix should get logged in a file. This file is saved and zipped inside a folder. Short introduction of related topics is given below. Design section and system overview section describe the actual experiment and its associated parameters. [5]

A. Cooperative Approach

To set up Torrent based environment, sender and receiver node is set up. Between these two nodes, multiple forwarding nodes act as forwarder. Encoding process is done by image capturing device. While sending packet, multiple paths are used by the sender. At multiple intermediate nodes, the decompression takes place. Result is accumulated at receiver node. For example, a Client C1, Neighbour N1 and Neighbour N2 are wirelessly connected to V1 Video Server network. All 3 nodes are near to each other. C1 raise a Video request. Neighbours N1 and N2 have spare information and, being willing to join, each connect with C1 employing a wireless ad-hoc network. C1 informs the Video Server regarding its active Neighbours and the video server V1 streams the video through all the obtainable nodes close to it. The V1 server sends frames information in a very file. [6] Information is in variety of code characters. Ex- [240, -11, 12,'r61'] it's a quantization matrix when zigzag travel complete, ac value is stored as 240. DC value is -11 and 12. r61 represent sixty-one zeros in 8 x 8 matrix. So, the total elements are sixty-four. It's a block of 8x8 pixels and similar info for all rest of the blocks must be convey to another node through intermediate nodes. This is to be done with R channel, G Chanel and B Chanel. Then every colour channel is split into 8x8 blocks. Each 8x8 block are reduced to 3-4 values tuple exploitation jpeg compression process. These tuples are hold on in file. Exploitation these dictionaries are recreated at receiver aspect and image is recreated.

B. Encoding Approach

Alternate design approach is also suggested. One can store R, G and B intensities as a one list. List item embody ['8 (2)','4 (3)', 'FF (F)']. In this case, two could be a code and eight times it's continual. Equally, three could be a code and four times it's continual. F could be a code and its continual FF times (255 times). So, similar colour if continued then it will be logged. It is temporal redundancy recording in a file using Colour code and colour index. Colour Index file contain following entries within the variety of dictionaries. 2: (FF, 87, 2A) Here 2 could be a code and FF is R intensity 87 is G intensity and 2A is B intensity. [7]

Now just in case of two adjacent pictures, one will determine the distinction between pictures. Whereas examination two pictures, the logic scan pixels' row by row. Logic may travel column-by-column additionally supported bound criteria. Then rule finds that at sixteenth position say, the component in second image is not like component in 1st image. It logs the entry in distinction file. 1F: '(FF, FF, FF)', this entry represents at position index 1F. It found a component having completely different combination of RGB. Instead of RGB value, RGB code can be also used. 1F: '(3B)', It indicate at position 1F, colour code 3B is found which is different than the colour code of reference image. [8] The video server sends frame one to the requesting node C1, sends frame two through Neighbour N1 and frame three through Neighbour N2. While streaming, the system totally utilizes the obtainable information measure all the 3 links and adapts dynamically to any amendment in information measure. These N1 and N2 act as seeds for consumer C1. C1 is mere accumulate decompressed information from N1 and N2 and merge final

combined media content. System performance is to be evaluated exploitation metrics like combination output and video quality. To assess the video quality, we tend to live the play out time, start-up delay and re-buffer events throughout streaming. [9]

C. Streaming Approach

When a user requests a video, the Neighbour Manager creates ad-hoc network and waits for Neighbours to hitch the ad-hoc network. The Neighbour Manager sporadically broadcasts REQUEST messages to seek out new Neighbours within the ad-hoc network that are willing to contribute information measure. The Neighbour Manager keeps associate updated information of active Neighbours willing to assist within the system. The Neighbour Manager monitors for periodic heartbeat messages (I-CAN-HELP messages) from the Neighbours and perpetually keeps track of Neighbours connexion and deed the Neighbourhood. [11] The Neighbour Manager sporadically informs the Video arrange Manager regarding the active Neighbours and changes in Neighbourhood (new Neighbours connexion and Neighbours leaving). The Neighbour Manager receives video frames from the active Neighbours and forwards it to the Buffer Manager. It keeps track of the frames received from every of the Neighbours and informs the Video arrange Manager. The Video arrange Module could be a core element of the consumer that perpetually informs the Video Server regarding the streaming arrange. The role of the Video arranges Manager is summarized below: The Video Manager constructs the streaming Meta data with Neighbour details and sporadically updates the arrange Handler within the Video Server. The streaming consists of knowledge regarding the consumer and Neighbour links (IP address and Port) that the Video Server will use to stream video to the consumer two. Once a brand-new Neighbour, able to contribute information measure, joins the ad-hoc network, the Video arrange Manager informs the Video Server regarding the Neighbour in order that the Video Server will quickly use extra information measure to stream. [12] Once a Neighbour leaves the network, the Video arrange Manager inform the Video Server in order that the Video Server will recover lost frames and stream through different active links.

VII. Result and analysis

The nodes, which are active in transmission, should be able to take decision in case of any link become active, inactive or ideal. If any link is inactive, it can switch the traffic. If any node is added in node, it should het discovered and its buffer should get added for processing and transmission. If the number of packets to be transmitted is scaled up to 100 and getting incremented, then the mechanism of evenly distributing packets delivery among the available path is described above must get followed. Below is the delay chart using compression algorithm and API mode of Xbee. It shows that JPEG image compression using fast Fourier transformation is quite effective and can be used for rapid processing. In addition, Dynamic Source Routing protocol can rapidly search and forward packet to the next hops and keeps node data for route decision making in future. Serial mode of XBEE can convey data more rapidly than API mode.

TABLE I
PACKET COMPRESSION

File Size	Delay	Compression
6 KB	16.5 sec	JPEG
5 KB	14.3 sec	HAAR
8 KB	22.0 sec	Colour Index Mapping

TABLE II
DELAY CHART USING COMPRESSION ALGORITHM AND SERIAL MODE OF XBEE.

File Size	Delay	Compression
6 KB	8.5 sec	JPEG
5 KB	6.3 sec	HAAR
8 KB	12.0 sec	Colour Index Mapping

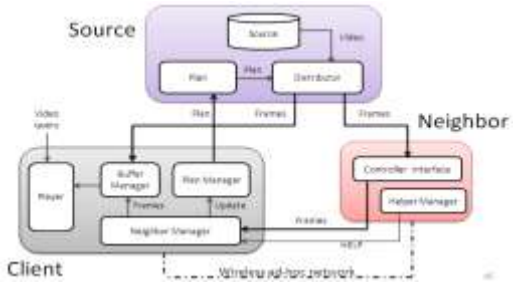

Fig. 1 A Proposed system architecture

```
('Received Bytes Size = ', 2950)
('Received Bytes Size = ', 3000)
('Received Bytes Size = ', 3050)
('Received Bytes Size = ', 3100)
('Received Bytes Size = ', 3150)
('Received Bytes Size = ', 3200)
('Received Bytes Size = ', 3224)
('add_flag_Size', False)
Received Code EOF ~<EndOFTran
Sent EOT Signal. ~<EndOFTran
('any.zip', 3224)
File writing operation is complete.
00:32:39.524000
-------------------------
Waiting for RTS = $$RTS
```

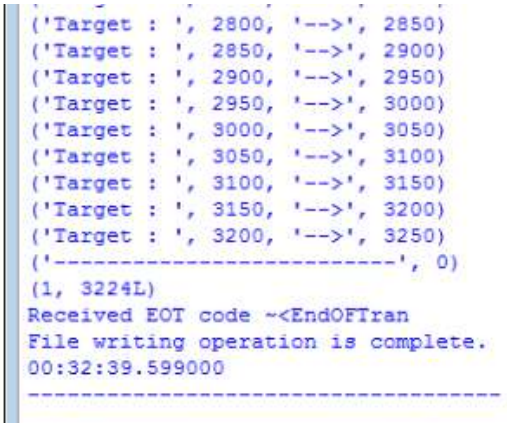

Fig. 2 A Proposed File transmission approach

CONCLUSIONS

The A colour-indexed image can be represented with a colour index map each element of which serves as an index to select a colour from a predefined set of colours called palette to represent the colour of a pixel in the image. Jpeg Compression can provide image metadata smaller in size. API mode of XBEE is not sufficient since data cannot be delivered fast. Serial mode of Xbee can be used to implement Torrent based architecture. Audio and Video can be transported from one hardware to another. To reduce the data to be transported, some encoding tools can be used.

REFERENCES

[1] Song Ci, Dalei Wu, Yun Ye, Zhu Han, Guan-Ming Su,Haohong Wang, Hui Tang, *"Video Summary Delivery Over Cooperative Wireless Networks".* Ieee Wireless Communications. (April 2012)

[2]. Ivan Kastelan, Mihajlo Katona, Goran Miljkovic, Tomislav Maruna, Mirko Vucelja, *"Cloud Enhanced Smart Home Technologies"*, Ieee International Conference On Consumer Electronics. (2012)

[3]. Lei Lei And Zhangdui Zhong, Chuang Lin, Xuemin (Sherman) Shen ,*"Operator Controlled Device-To-Device Communications In Lte-Advanced Networks",* Wireless Communications. (April 2012)

[4]. Jun Zhang And Khaled B. Letaief, *"Interference Management With Relay Cooperation In Two-Hop Interference Channels",* Ieee Wireless Communications Letters, Vol. 1, No. 3. (June 2012)

[5]. Jin-Bum Hwang And Chae Y. Lee, Member, Ieee , *"Effective Video Multicast Using Svc With Heterogeneous User Demands Over Tdma Based Wireless Mesh Networks"*, Ieee Transactions On Mobile Computing. (2012)

[6]. M. Majid Butt,*"Energy-Performance Trade-Offs In Multiuser Scheduling: Large System Analysis"*, Ieee Wireless Communications Letters, Vol. 1, No. 3. (June 2012)

[7]. P. Ubaidulla , And Sonia A¨Issa, Senior Member, Ieee, *"Optimal Relay Selection And Power Allocation For Cognitive Two-Way Relaying Networks"*, Ieee Wireless Communications Letters, Vol. 1, No. 3. (June 2012)

[8]. Nof Abuzainab, Anthony Ephremides, *"Energy Efficiency Of Cooperative Relaying Over A Wireless Link"*, Ieee Transactions On Wireless Communications, Vol. 11, No. 6. (June 2012)

[9]. Kushal Dutta *"A Smart Job Scheduling System For Cloud Computing Service Providers And Users: Modeling And Simulation"*, 1st Int'l Conf. On Recent Advances In Information Technology Rait , (2012),

[10]. Özgü Alay, Student Member, Ieee, Pei Liu, Member, Ieee, Yao Wang, Fellow, Ieee, Elza Erkip, Fellow, Ieee, And Shivendra S. Panwar, Fellow, *"Cooperative Layered Video Multicast Using Randomized Distributed Space Time Codes"* , Ieee Ieee Transactions On Multimedia, Vol. 13, No. 5, (October 2011)

[11]. Zhangyu Guan†‡, Lei Ding‡ , Tommaso Melodia‡, And Dongfeng Yuan† , *"On The Effect Of Cooperative Relaying On The Performance Of Video Streaming Applications In Cognitive Radio Networks"*, Ieee Icc Proceedings. , (2011)

[12] R. & Srivastava, M. Ganeriwal, S.; Kumar , *"Time Sync Protocol For Sensor Network, The First Acm Conference On Embedded Networked Sensor System (Sensys)"*, Los Angeles, Pp. 138–149 , (Nov 2005)