A Review Paper on an Efficient Data Reduction Technique using Change coding for wireless visual sensor network

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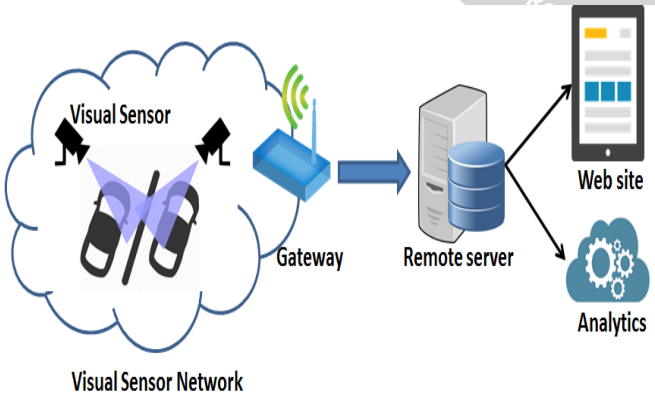
Abstract: Wireless Visual Sensor Network is one of the most important applications of wireless Sensor Network which provide a sensor based intelligent distributed system. Visual Sensor Networks has less complexity, identical performance and better quality of service. Visual Sensor Network contains large number of camera nodes for providing visual view of an object. The majority industries use a network of cameras in order to obtain real-time data for monitoring and control. These networks are wired based in which data is sent over a wired link and power is available from wall power supplies. The Captured Image from Camera or Dataset needs to reduction in the Images for uploading to the server. In change coding XOR operation of two adjacent frames is takes place. Finally image will be uploading to the Server, which helps in reducing the energy consumption of the Visual Sensor Network. In that situation, there is need to apply Data reduction and Change coding technique to improve the system performance.

Keywords —Change coding, Image processing, Image sensor, MATLAB, OpenCV, Raspberry pi,

I. INTRODUCTION

Wireless visual sensor networks (WVSN) has capability to capture image, store image, communicate and processing the image which is used for visual observation. The main difference between wireless visual sensor network and other sensor network is the way of image sensor receives the information from monitoring area. Therefore wireless visual sensor networks are unique and perform very challenging task as compared to other sensor networks.



Fig, wireless sensor network

Extensive research has been performed on different image and text compression techniques. Wireless visual sensor network is one of the most important application of wireless sensor network which has capability to cover a specific area. For monitoring those areas have created some limitation such as restricted bandwidth, quality of captured image, data processing and energy consumption.

Recently, because of development of image sensor technology much attention is required in research of wireless visual sensor network for security, surveillance and other applications.

II. LITERATURE REVIEW

Carl J. Debono, and Nicholas P. Borg, presented data reduction method using Least Mean Square(LMS) algorithm which is implemented by using Field Programmable Gate Array (FPGA) technique. The protocol is implemented by using UART, timer, data synchronization technique and RF module which is interfaced to FPGA. By using this method they maximize the lifetime of network. [1]

Mario Cordina and Carl J. Debono, presented cluster based routing algorithm which is based upon Fuzzy ART logic. They use filtering algorithm for reduction of transmitted data for increasing the lifetime of network. The simulation result shows more efficiency than the LEACH protocol. Proposed method increase the lifetime of the network provide better vision for environment monitoring. [2]

Saeed Mirshams, Kamal Jamshidi and et.al, predented a clustering method for data reduction which improves the system performance and energy consumption. The numbers of nodes are grouped together for sending and receiving data packets to its adjacent nodes and each group contains

one cluster head. By using MATLAB simulation result is obtained over 200 iteration. By using this algorithm, bandwidth and energy is improved which is most important parameters in wireless sensor networks. [3]

youssef charfi, bell canada naoki wakamiya and masayuki murata, discussed different issues of VSNs, new challenges, transmission bandwidth requirement and power consumption. Also they states camera coverage method and algorithm for focal length. Network design architecture is classified into homogeneous and heterogeneous architecture. Also visual data filtering and visual data coding plays vital role in visual sensor networks. [4]

Muhammad Imran, Khursheed Khursheed, and et.al, states that there are number of challenges in wireless vision sensor networks. They focused on 2 methods which are classified into vision focusing between different sensor nodes and central base station. 1st method contains data transmission without any pre-processing to central base station and 2nd method. [5]

Ramona Georgescu, Christian R. Berger, et.al, proposed 4 data reduction techniques such as Principal Component Analysis (PCA), Partial Least Square (PLS), Structurally Random Matrices (SRM), and Orthogonal Matching Pursuit OMP). These techniques are applied on 2 datasets like Wisconsin diagnostic breast cancer (WDBC) and Ionosphere. Its performance can be classified using SVM analysis provides a useful tool for reduction of signal processing load with better performance. [6]

Nyoman putra sastra, Wirawan,et.al, states a new method for capturing a virtual view of an image by selecting cameras in wireless visual sensor network. Also main objective is maintaining bandwidth and energy limitation without disturbing the information quality of an image. For that system IMB 400 Imote 2 sensors are used with 640×480 pixels resolution. There are 5 sensors are used with Embedded Linux operating system. They pick one camera for visual perception. The experimental result shows that size of image is 901KB with speed 250 kbps is required for transmission. [7]

Mohamed O.abdel-Aal, Rabie A. Ramdan, presented a new protocol for energy saving and maintain overall lifetime of sensor node. This protocol gives the accuracy and reliability for transmission of data as compare to other protocol which are used in WSNs. 1st approach contains different types of wireless sensor networks such as single and multimodal. 2nd protocol use fuzzy logic technique for fulfill the requirement of energy saving applications. For the data reduction in single and multimodal WSNs, exponential smoothing predictors are used. The reliability of those predictors is calculated by using standard deviation (SD) and coefficient of variance (CV). Fuzzy logic algorithm is used for getting the probability of occurrence. For the data reduction, fuzzy logic algorithm gives the maximum energy saving as compared to other approach. Further implementation is required for clustering and routing algorithm. [8]

Khursheed Khursheed, Muhammad Imran, implemented image compression technique which has efficiency of reduction of information capture by visual sensor network as well as reduce the communication energy. The technique is used for data reduction in Region of Interest (ROI). Coding method is used for detection of various kinds of shapes, location and number of object into the frames. The main objective of ROI coding is making the system less complex and reduces energy consumptions in VSNs. In Ubuntu operating system the G-zip (GNU-zip) compression is used. In image processing library JBIG2 (joint bi-level image expert group) compression method is used. CCITT (international telegraph and telephone consultative committee) group 4 is most preferable as compare to other two techniques because of its better compression performance. Therefore ROI detection method along with CCITT group 4 has better performance for data reduction in WVSNs. For further data reduction in header information, study of redundancy is suggested. [9]

Khursheed Khursheed, Muhammad Imran, represent six Bi-level image compression technique for efficiency and reduce the complexity which is suitable for Wireless Visual Sensor Networks. They studied image compression methods such as Rectangular Edge Coding (REC), Ziv-Lempel algorithm, Arithmetic coding, Relative element address designate (READ), JBIG2 (joint bi-level image expert group), G-zip(GNU-zip). Coding performance can be analyzed by increasing number of object into the image and increasing size of object in image. Hence they gives the conclusion is JBIG2, CCITT group 4 and Gzip are better technique for Bi-level image compression in WVSNs. [10]

S.Renugadevi, P. S. Nithya Darisin, presented a data compression methodology which is based on Huffman and Lampel-ziv coding technique. For the implementation of Huffman coding, a analog data from sensor is used instead of ADC. For this algorithm a highly correlated data is generated which is considered as a symbol. Then probability of frequency of occurrence is calculated which is in encoded form. For the retrieval of original data decoding is used. LZW is applicable if data is in the character form. It is not applicable for the numeric data. Therefore for the conversion of numeric to character form data preprocessing is required. By using both techniques higher compression ratio is achieved as compare to other technique. [11]

Daniel G. Costa,et.al, proposed a method for availability assessment for particular coverage area in WVSNs. It also checks the sensing redundancy and disconnection of sensors. Target coverage in WVSNs can be optimized by

getting sensors views, target monitoring and sensing redundancy. Availability assessment is calculated by using fault tree [FT] model, which defines condition to detect failure of WVSNs. Addition investigation is required for different target application which covers different area. [12]

Khamees khalaf Hasan, umi kalthum Ngah, studied the different types of image compression techniques for different VSN platform such as Cyclops, Mesheye, Panoptes, Meerkats,Vision Mesh etc. They state a comparative analysis of basic image compression techniques used in visual sensor networks with its requirements of implementation. They also analyze image compression scheme which has simple coding and low memory requirement. The performances of these techniques are evaluated by hardware based technique like FPGA and ASIC circuits. Further research is carried out for energy consumption, efficiency and processing time. [13]

Thaker Maulik B., prof. uma Nagaraj, mainly focused on energy optimization and data reduction technique in wireless sensor networks. For the data reduction technique preprocessing is required for maintain the storage. They studied different data reduction techniques such as Adaptive filter, Tree based method, Cluster based method, Data stream based reduction, Hybrid data reduction and Data prediction based reduction. They state the advantages and disadvantages with different characteristics. They analyze the recent trends, updates and real time applications for the system. Therefore more future work is required for organization of suitable technique for different kind of wireless sensor networks. [14]

Daniel G. Costa, Luiz Affonso Guedes, performed some recent optimization techniques in wireless visual sensor network. They discuss some prioritization parameter such as energy, data type, sensing, relevance, hardware capability, coding and confidentiality along with its scope which is global or local. They studied different protocol for priority optimization. They face some optimization issues such as unreliability for packet transmission, delay, coding redundancy etc. [15]

Manisha P. Mashere, Sunita S. Berve, studied different data reduction technique and algorithm such as data prediction using LMS algorithm, adaptive filter technique for stationary and non-stationary signals, Voronoi Tesselation Transformation, Dimension reduction method and Fuzzy logic algorithm. [16]

Pramod D.Ganjewar, et.al, presented Threshold Based Data Reduction Technique which is useful in data preprocessing as well as minimization of energy for transmission of data. In WSN, data transmission is more energy consuming that's why this technique is applied after transmission of the data. A tiny sensor is attached to patient body which randomly gives the information about heartbeats of patient. After transmission of the information to the sensor node the algorithm is applied this alerts the doctors according to threshold values. [17]

Liansheng Tan proposed a data communication technique by using hierarchical least mean square (HLMS) adaptive filter which utilize for both source node and sink node. By using this data reduction technique power saving is achieved by reducing specific data. In HLMS algorithm, author uses 54 sensor nodes which are installed in a lab and continuously measure the temperature of that lab during the time interval of 31 sec. when this result is compared with QLMS algorithm, it is observed that HLMS is most superior than QLMS. The simulation results shows that HLMS achieves 95% communication reduction of data i.e. measurement of temperature with high accuracy. The future work of this research is working on packet loss condition in WSN and synchronization of filter. [18]

Shamim Yousefi, Samad najjar Ghabel, performed 2 object detection methods for solving detection of object problem in VSNs as well as they works on reliability energy consumption and detection of accuracy for real time environment. In 1st approach, object is detected by using background subtraction and reconstruction of image technique and multiple objects are detected by using Haar transform. In 2nd approach, they states that camera node perform very important task for capturing the images. In this method they use Binary Invariant Scalable Key-point (BRISK) technique for reorganization of an image. [19]

Shabir Ahmed Sofi, Roohiew Naaz, given an analysis for real time environment monitoring using different wavelets for efficient image data transmission in wireless visual sensor networks. They developed a system for selecting the area in which image was captured. For data transmission using Zigbee technology is used. A continuous wavelet transform (CWT) is used for monitoring medical image and seismic signals. Discrete wavelet transform is used for signal compression. Authors uses Haar transform for this analysis. The system is implemented along with MATLAB. [20]

S.Aruna Deepthi, E.Sreenivasa Rao, proposed a image compression method which is combination of Haar and Hadamard transform. Combination of this algorithm is applied on lossy and lossless image compression.1st image is compressed by using Haar wavelet transform and Walsh Hadamard transform, then quantization and entropy encoding is applied on image. This compressed file is transmitted towards the sensor network. At the receiver side inverse operation of compression is applied which is inverse Haar transform, Inverse Hadamard transform, de-quantization and decoding respectively. In this way original image is obtained. [21]

Abdallah Makhoul, et.al, presented 2 techniques of data reduction which are less complex and suitable for sensor nodes. The 1st technique contains kruskal-Wallies test, which reduce data by adapting their sensing rate with continuously varying sensed data. The 2nd technique collects the online data having some properties before sending to sink. For data acquisition Kruskal-Wallies test is used which verifies high variation of collected data. For evaluation of this test 4 crossbow telosB motes continuously measure the temperature and humidity in a lab for about 3 days. This test is most superior than Barlett and S-LEC test because sampling rate is greater to these both techniques. In nesC programming, it does not provide any model for energy consumption. In this system a radio model is used to evaluate the energy consumption which is directly proportional to data collect/sent. According to Results, Kruskal-Wallies test consumes less energy than S-LEC test and false rejection probability is 12% less than Barlett test. [22]

Reza Ghazalian, Ali Aghagolzadeh, proposed a method for optimization of energy with maintaining Received image quality. This problem is solved by selecting a new algorithm for target tracking. Also a formula is developed to calculate number of bits and display the pixel of an image. By using the algorithm they calculate distance between nodes, focal length of camera node, number of bits to display image and selection of minimum distance for tracking target. For the analysis MATLAB simulation is used and result is compared with Minimum Distance Target (MDT) algorithm for finding minimum distance. [23]

Monaem IDOUDI, et.al, presented a system for patient Rehabilitation using WVSN. The main objective of this system is to create a platform for tracking a patient and real time localization. By using IOT platform system improves localization accuracy as well as efficiency of WVSNs. This system contains RPi3, Kinect and ID sensor for processing, capturing image and identification respectively. It is a low cost, easy to use and lightweight monitoring system which is helpful for home as well as in hospitals. [24]

Khursheed Aurangzeb, Musaed Alhussein, presented the image compression technique by making changes in size, shape, and location of objects. Compression in change frames provides better analysis as compared to compression in original frames. For reduction of noise morphology technique is applied on change frame. By using this technique, experimental results shows that energy consumption is reduced. [25]

III. SUMMARY

Wireless visual sensor network (WVSN) is one of the most important application of wireless sensor network. WVSNs are applicable for number of applications such as surveillance, wild life monitoring, industrial observation and security purpose etc. Visual sensor networks are used for getting visual view of an object therefore large amount of image data is stored into the system. But every sensor network has some limitation like bandwidth, storage and energy consumption. There are different data reduction techniques are used for increasing lifetime and bandwidth of wireless sensor network.

Now a day, visual sensor network plays very important role in wireless sensor network likewise there is number of challenges and issues are generated. For that purpose, an efficient data reduction technique is required for capturing image, pre-processing and storage purpose.

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