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Achieving Energy Efficiency using Adaptive Routing Algorithm in Visual Sensor Networks

S. Kalyani[1]
M.E
Computer Science and Engineering
Francis Xavier Engineering College
Tirunelveli - India

L. K. Sudha Sankari[2]
M.E
Computer Science and Engineering
Francis Xavier Engineering College
Tirunelveli - India

Dr. R. Ravi[3]
M.E., Ph.D
Professor & Head of CSE
Francis Xavier Engineering College
Tirunelveli - India

Abstract: ***Visual Sensor Networks (VSNs) have emerged as a key technology for next-generation wireless networking. Routing also plays a vital role in Visual Sensor Network. In Visual Sensor Networks frequent congestion or link failures are caused by channel interference, energy consumption and bandwidth demands. Sometimes these failures lead to node partitioning in the network. Then these failures cause performance degradation in VSNs. Finally the throughput is reduced and it becomes less energy efficient. To overcome these drawbacks, this paper presents a backpressure algorithm. It is used to route each packet along the required path in the network. Backpressure algorithm prevents the node becoming dead during node partitioning. However this algorithm increases the throughput but there is little delay in routing the packet. For this purpose Adaptive routing algorithm was proposed. It uses shadow queue approach which is used to queue the packet according to the priority. Using this algorithm delay in routing the packet to destination is reduced. Finally the throughput is increased and it achieves energy efficiency.***

Keywords: Backpressure algorithm, Adaptive routing, Visual sensor networks.

I. INTRODUCTION

A Visual Sensor Network (VSN) is a network of spatially distributed smart camera devices capable of processing and fusing images of a scene from a variety of viewpoints into some form more useful than the individual images. VSN may be a type of Wireless Sensor Network (WSN). Each node in the network generally consists of the camera with it which is used for some local image processing communication. It is also used in processing the image data from multiple cameras. This processing take place in a distributed fashion across the cameras and their local controllers. VSN also provide some high-level services to the user so that the large amount of image data can be processed into information of their needs. The primary difference between VSN and other types of sensor networks is the nature and volume of information the individual sensors acquire.

A. Visual Sensor Network Architecture

Visual Sensor architecture is effective in providing cost effective and dynamic high-bandwidth networks over a specific coverage area. Fig 1 shows the VSN architecture.VSN architecture is classified into three types such as topology based, technology based and node based. It is built of peer radio devices that do not have to be cabled to a wired port like traditional Wireless Loacl Area Network (WLAN) access points mesh architecture sustains signal strength by breaking long distances into a series of shorter hops. Intermediate nodes not only improve the signal, but cooperatively make forwarding decisions based on

their knowledge of the network. This type of architecture with careful design provides high bandwidth, energy efficiency, and economic advantage over the coverage area.

VSN has three types of components such as visual point, sensor access point and sensor portal. Visual point helps each node in the network for the delivery of the packets. Sensor access point works with the functions of middleware transmission in the network. Sensor portal act as the bridge for interfacing two networks, and usually connects the wired network with the VSN. The principle used in VSN is similar to the way the packet travel around the wired internet that is data will hop from one device to another until it reaches the destination.

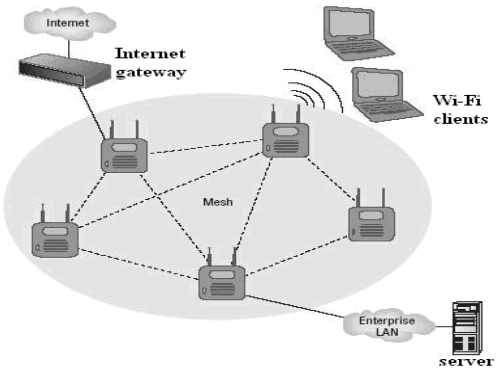

Fig 1 Visual Sensor Architecture

II. System Analysis and Design

Visual Sensor Network (VSN) experience frequent link failures which are caused by congestion in the node, due to channel interference, link failures, and dynamic obstacles. These failures cause severe performance degradation in VSN or require expensive manual network management for their real-time recovery. Even though there are many solutions for VSN to recover from wireless link failures. But they still have several limitations as follows.

First, there are n number of sensor nodes are randomly deployed. In order to transmit data between sender and receiver it uses AODV routing algorithms. It is used for the data transmission during routing the data congestion occur at particular node in the network. Due to congestion that particular node gets partitioned into another two nodes. During the partitioning one node become dead and another node become alive. Since the node become dead it cannot do further transmission. Second, during routing in the network at the particular node the transmission is blocked. So that it cannot communicate to its neighbour node. Due to this reason it leads to buffer overflow and packet may be discarded and there may be also bandwidth demand.

A. Drawbacks of existing system

- Due to congestion it is difficult to maintain a deterministic route.
- When the node becomes dead it is difficult for transmission.
- It cannot communicate with it neighbouring node.
- This leads to delay in routing the packet.
- Finally the throughout is reduced then the performance and efficiency is degraded.

To overcome the drawbacks of existing system first backpressure algorithm was introduced. This algorithm helps in partitioning the node. Backpressure algorithm prevent from node becoming dead. It is used to maintain a deterministic route. It helps in packet transmission in an efficient manner. So the throughput is increased but there is still little delay. Second, the adaptive routing algorithm was proposed. It prevents the transmission block in the network during routing and delay in transmission. It uses shadow queue approach. So that the packet are transmitted properly to the destination. This prevents buffer overflow and packet discarding is also avoided. So that finally delay is reduced and the energy efficiency is achieved.

B. Advantages of proposed system

- Backpressure algorithm prevents the node becoming dead during partitioning.
- It is used to communicate with it neighbouring node without any external disturbance.
- It is used to route packets on shortest hops.
- It reduces the delay in routing the packet.
- Finally the performance is improved and energy efficiency is achieved.

III. SYSTEM IMPLEMENTATION

The overall system model is explained as follows. Initially when the packet arrive into the source node, the source node become ready for its transmission.Fig 2 shows the overall system model for implementing backpressure algorithm.Before starting the transmission the entire network is monitored by sharing the information through visual sensor camera in each and every node.

When the source node transmits to its neighbouring node, the probability updater is updated at each and every time. After the updating the status of each and every node is monitored. It checks whether the entire node in the network are alive by preventing congestion. If the nodes along the required path are alive, then the transmission is performed. All the packets are efficiently routed towards the destination node. If any one of the node is dead, backpressure algorithm is implemented and network is monitored. The same process is continued until the node becoming node. Thus the performance is improved and throughput is also increased.

The implementation is described as follows.

A. Node creation

In this module, when a new node enters into a sensor network. The nodes itself have to register within the network. Every new node has to register with the network communication range at the first time when it enters the sensor network. The network generally consists of the cameras themselves, which have some local image processing communication in which the image data from multiple cameras is further processed and fused. The detail such as IP addresses bandwidth, connection status and time of node creation. The connection status get often change according to available bandwidth of a sensor node.

B. Detection of congestion in the network

During routing or packet transmission in the sensor network. There may some physical disturbances. This may lead to frequent link failure which is the major cause of congestion in the network. Once the congestion occur at any of the node in the network. The node gets partitioned into two.

- Dead node
- Alive node

The dead node cannot transmit packet to its remaining node even though it receive packet. It is unable to communicate with its neighboring node and the transmission cannot be carried out in the normal sequential order. So that all the packet are not received by the destination node due to congestion in the network. To overcome this difficulty backpressure algorithm is implemented.

C. Implementing Backpressure algorithm

During the partitioning of node due to congestion, the node becoming dead is prevented by implementing backpressure algorithm. It is used to maintain a deterministic route. It helps in packet transmission in an efficient manner. So that all packets

are routed to their destination node accordingly they determined. It also route packets on shortest hops. Finally the throughput is increased but the delay in transmission is not prevented. However the energy efficiency is also not achieved because congestion is not completely prevented. This is due to it helps only in node becoming dead.

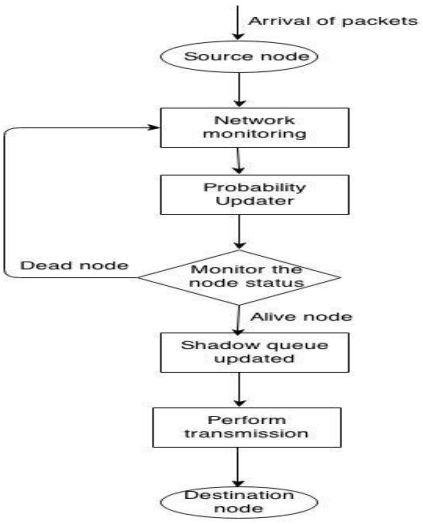

Fig 2 The overall system model

D. Implementing Adaptive routing algorithm

During routing the transmission may block at any node. It may receive packets but unable to transmit. This may lead to buffer overflow or link failure or congestion in the network. The link failure may be of two types. They are self failure, path failure. In self failure, the node itself has failed due to a crash, re-boot, error in software code, or connectivity issue. In path failure, a node along the path fails causing other nodes to fail or there are collisions along the path.It finally results in packet loss. To avoid these drawbacks Adaptive routing (AD routing) algorithm is implemented. It uses shadow queue approach which is used to queue the packet. The packets are queued based on the priority they arrive. So that there is no packet loss and the trans mission is carried out in a efficient manner. Finally delay in transmission is reduced and energy efficiency is achieved.

D. Performance evaluation

When the performance is compared between the backpressure algorithm, the throughput is increased initially in backpressure algorithm, but due to delay the throughput gets reduced. Fig 3 shows the adaptive routing algorithm by queuing the packet, the transmission is carried out in a sequential manner. Here the delay is reduced and the throughput obtained is maximum. So finally it achieves energy efficiency.

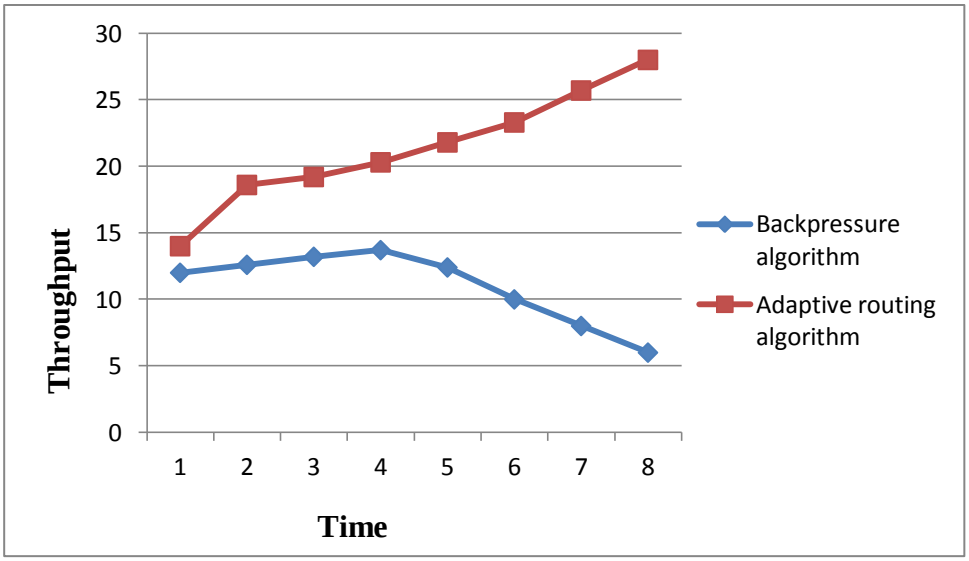

Fig 3 Comparison between Backpressure algorithm and Adaptive routing algorithm

IV. Conclusion and Future Enhancement

This project presented a backpressure algorithm which maintains a deterministic route to avoid dead node during the partitioning of node in the network. It also has probability updater which updates the route on each transmission. This algorithm mainly helps in routing the packet on shortest hops. Hence the throughput is increased and the performance is improved. Next, adaptive routing algorithm implements the shadow queue approach. It helps in routing the packet according to their priority so that congestion or buffer overflow may be prevented. It also reduces the queuing complexity at each node. Finally the delay is increased and the energy efficiency is achieved in Visual Sensor networks.

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