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Reliable Routing Algorithm for Wireless Mesh Network in Disastrous Prone Area

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Abstract **- The network that carries most of traffic is the backbone transmission network if it is unable to carry any traffic once it's broken. Then mesh clients would take up the traffic and transfer data. In this paper power cost of each node is main criteria considered. The algorithms used in this paper are reliable routing algorithm and fault recovery routing algorithm. Simulation results prove the fact that algorithm has shown reliability in both efficiency and energy of clients.**

I.INTRODUCTION

Wireless network interconnect many people to communicate and browse internet from their desired location. This is the advantage of using wireless network compared to wired network as for wired network long wires have to be drawn to the access points and each device has to be interconnected through wires they consume space, creates chaos and costs a lot of money.

Wireless mesh network proposed in this paper is similar to wireless network but difference between wireless network and wireless mesh network is that in wireless mesh network can cover an entire area whereas wireless network can cover a building or neighborhood buildings. A wireless mesh network has many advantages such as:

1) Smooth installation –Wireless mesh network is an expanded form of wireless network. It is same as wireless network but covering more areas; hence it has same protocols and equipments as wireless network. The cost of equipment is less compared to other network. Cables are not needed to provide network for entire city.
2) Good Coverage-Wireless mesh network consists of many nodes; if any one of them fails then remaining nodes would take up the traffic.
3) Self-Conservation-In wireless mesh network, there is a concern on congestion. During congestion, traffic is diverted to nodes which are not under failure and to reduce downtime.
4) Greater Speed-In wireless mesh networks each and individual node is a server, unlike traditional network where a single server handles all data. In wireless mesh network each node is a server, so every single node handles data; hence data can be accessed faster.

Coal mining is another example of disastrous prone area and little research done on coal mining, a foremost coal production happens in china. Coal production causes about to some considerable amount of non reusable energy consumption in China and from a long period of time it has an important role in profitable and public development of China as a type of most needed vital resource. Ordinary radio systems can provide very limited and weak communication capability in confined spaces. As coal work and tunnel digging work are constantly being done in worst environment conditions. Hence, wired communication networks cannot be placed in these areas as there are some spots with decrease in performance and network security presented in the wired communication and audit systems in the underground mine. While they are working, members in underground mine need to transmit video, voice, and environmental conditions to the commanders on the ground through the wireless communication system as wired communication cannot be used in these areas.

As we saw advantages of wireless access network, wireless mesh networks (WMNs) are multihop wireless networks consisting of three types of nodes, mesh routers, mesh clients, and gateway nodes that are meant for their special features such as self-mending and self-build. Wireless networks have the features of elevated communication rate, extensive broadcasting, quick implementation, flexible networking, and scalability; all these features show superiority over wired communication network and traditional wireless networks. The architecture of WMNs can be classified into three main groups based on the functionality of the nodes such as mesh routers, mesh clients and gateway.

In this paper the proposed communication network is hybrid wireless communication network based on its

networking and routing features. Mesh clients are used for wireless networking in underground mine. But the client nodes have limited energy. So, in this paper, energy consumption and efficiency of clients has to be balanced a factor energy cost criterion is considered for this purpose.

II.LITERATURE SURVEY

Wireless mesh networks in disastrous prone area such as coal mines are established to provide applications that enable communication in case of emergency rescue operations; hence a study is conducted on wireless mesh network that involves multihop transmission performance, network planning and coverage, channel allocation and resource management. The study on resource management of wireless mesh network in coal mine can be divided into two categories:-

A. Linear Topography- In [5], an emergency communication system based on wireless mesh network in underground mine. In this paper the deployment strategy of gateway nodes is examined. Deployment of gateway nodes is important and different algorithms are proposed for deployment because energy consumption is a big problem in wireless network as each node is attached with battery which is limited in size.

In [6] same emergency system is constructed as [7] but simulation results show that bandwidth decreases and latency increases after multihop in wireless mesh network by using portable relay nodes but this paper does not provide a solution. In [13] multihop performance of backbone network is studied and achieves very low attenuation. Designing multiple relay nodes in this paper can achieve us with resource management of wireless mesh network in coal mine.

B. Shredded Chain Topology- Wireless mesh network designed as shredded topology; as such topology is mainly used for rescue operations in coal mines. In this topology there are many options available there is nothing such as one restricted option available. The channel expected traffic [8] with various and different routing schemes are analyzed such analyzation is helpful for the application of wireless mesh network in destructive prone areas. To make suitable bandwidth requirements of channel in this topology of wireless mesh network there are altered channel allocation strategy proposed [9] to improve performance of network.

The above research is based on problems in backbone network of strip topology. The problem is that failing of routers in the backbone network causing entire disconnection of network. Mesh clients in hybrid wireless mesh network provides data forwarding in case of router failure but mesh clients consume more energy in wireless mesh network. Therefore, a energy optimized routing algorithm has to be designed.In [10] to solve this problem various energy optimized link commission and routing complication are defined. Two different integer even programs are defined to solve the problem. The problem with this algorithm is that they produce communication overhead due to their architecture. In [11], a potentially aware routing algorithm is defined. This algorithm selects efficient routes based on connection between nodes and energy along the path. Hybrid wireless mesh network is designed for accident prone area

In **[1]** Wireless Mesh Network (WMN) dawned as wireless mechanics for several advanced applications like video on demand, wellness program systems, misfortune, difficulty, modern intelligent transport systems, public security systems, broadband internet for home and campus networking. Routing feature is mainly provides data packet transfer from source node to destination node .Wireless routing is deviated from routing in a wired network. For routing protocols the routing measures show their performance in wireless mesh networks (WMN). The routing measures of routing protocols as these routing protocols are implemented routing measures are earmarked to variant paths. Their job is to gauge the prime routing path. Routing measures are incorporated in routing protocols to intensify reliability, latency, throughput, error rate and cost of wireless mesh network (WMN). This paper presents a survey of important routing protocols and routing metrics for wireless mesh network (WMN).In an IEEE paper routing measures of Multi Hop Wireless Mesh Network are very needful for calculating optimum essence path. This is done by grasping a favourable link for Internet Service Providers (ISP) is provided on it. Depicting broadband service access and a robust network with exceptional routing metric is demanding due to the latency of static and other end-users to come across with consistent wireless nodes and common wireless medium in wireless mesh network (WMN).

Paper [2] commenced taxonomy of energy efficient clustering algorithms in wireless sensor network (WSN).It has also given history and description of low-energy adapting clustering hierarchy (LEACH) routing protocol used in wireless sensor network (WSN). To amplify the network lifetime of Wireless Sensor Networks (WSN) exquisite paths

are selected for data transfer such that the unmitigated energy dissipated along the path is minimized. For abutment of tremendous scalability and better data aggregation, sensor nodes are often grouped into dislocated subsets called clusters. Clusters beget hierarchical wireless sensor network (WSN) to subsume productive utilization of constrained resources of sensor nodes and increase network lifetime. The main aim of this paper is to provide a survey on clustering algorithms as given in literature of wireless sensor network (WSN). In
Wireless sensor network (WSN) the sensor nodes are mostly grouped into disjoint sets called as clusters. Clustering is used in Wireless sensor network (WSN) because it provides network compatibility; resource allocation and qualified use of coerce resources that commit to provide network topology substantiality and energy preserving attributes. Clustering schemes guarantee to provide truncate communication overheads and skilled resource allocations therefore contracting the overall energy consumption and reducing the interferences among sensor nodes. Ample number of clusters occupies an area with small size clusters and these small size clusters will disable a large amount of messages transmitted from cluster members. Low-energy adapting clustering hierarchy (LEACH) protocol is a routing protocol based on clustering and finds the superlative number of clusters in wireless sensor network (WSN) to liberate energy and reinforce network lifetime. In this paper, a survey on clustering algorithms in wireless sensor network (WSN) is conducted. We have discussed the advantages and disadvantages of clustering along with a survey of low-energy adapting clustering hierarchy (LEACH) and its descendant.

A survey on different clustering algorithms in wireless sensor networks(WSN) along with low-energy adapting clustering hierarchy (LEACH) and descendant reported in the history of wireless sensor network (WSN) till date and conferred the comparison of different low-energy adapting clustering hierarchy (LEACH) descendant. We have found that the some energy efficient algorithms increases the network lifetime Although every effort has been made to provide complete and accurate state of the art survey on energy efficient clustering algorithms along with low-energy adapting clustering hierarchy (LEACH) and its descendant as applicable to wireless sensor network (WSN).In paper [3] basically focuses on the classification layer and immensely actual approaches are concerned about the conservation of energy. This paper also discuss about the work on energy saving in wireless mesh networks (WMN). Reducing the transmission of CO_2 is a major topic discussed to avoid global warming. Since previous few years, wireless and mobile communications are progressively demanded by the consumers. Wireless Mesh Networks (WMN) is a very good wireless network it can maintain wireless connectivity through very cheap and an extremely flexible backhaul infrastructure all these are solutions to disadvantages faced in wired communication network. Wireless Mesh Network (WMN) is a new invention that has been adopted for all problems faced in wireless internetworking. As energy consumption in the information technology (IT) industries is increasing it has a very bad influence on the environment, energy efficiency has become a pivotal circumstance to calculate the performance of a communication network.In Wireless Mesh Network (WMN), the resources of Wireless Access Networks are finished long ago and only a small proportion of the device capacity genuinely is used and proceeds to high energy waste. This means that power consumption does not decrease by nonessential traffic but by turning on irrelevant device and it is saved by turning off these devices using only the needed ones.

In paper [4] proposes a power and node-type-aware routing algorithm (PNTARA) in wireless mesh network (WMN) discriminating optimized routes depending on a communal deliberation of the nodes' type and power levels along the path. Simulation results prove that algorithm propounded in this paper can representatively meliorate the network performance by moderating the power consumption and network overhead during this time packet delivery ratio has to be increased with decreased end-to-end delay has to be maintained.

Wireless Mesh Networks (WMN) concatenates hasty portable backbone networks and disseminated mobile ad hoc networks with ascetic-composed, ascetic-grouping and ascetic-contour features. These facilities make Wireless Mesh Networks (WMN) a promising technology for bright management communications.

A fact that every network needs reliable routing paths to recover from any network failure and predicament response operations, when already existing communication infrastructure and power resources have been destroyed. Power-aware routing shows an essential connection in providing prolonged emergency service. All the previous power-aware routing algorithms did not completely

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accomplish the characteristics of wireless mesh network (WMN).

III. NETWORK ARCHITECTURE

The topology used is linear topology in this topology ABCD, ABEFGH, ABEIJKL. This topology is a wireless mesh network deployed in disaster prone area example - coal mine. In the coal mine wireless mesh network is placed in underground mine. The architecture is shown in figure 1.

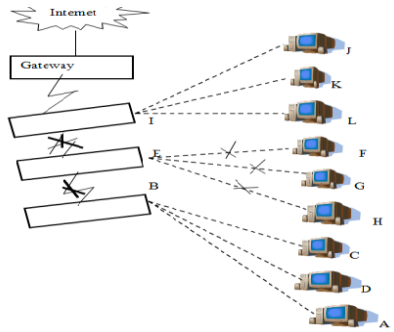

FIGURE 1: Linear Topology

If there is any breakdown in routers data from routers won't reach the clients and also data won't reach the gateway.

In figure 2, if there is breakdown among routers, then data is transferred between the clients and reaches the gateway.

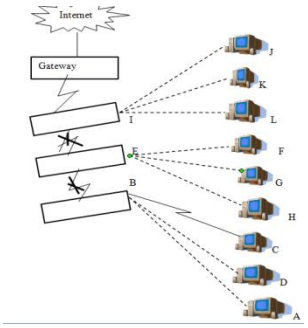

Figure 2: Shredded chain topology

IV. Algorithm Implementation

AODV (Ad hoc On Demand Distance Vector Routing Algorithm) is used .It is reliable routing algorithm route is established only when needed. There is routing table maintained. Entry in table is checked by using timer, entry in table will be removed if it is not recent. AODV algorithm uses broadcast mechanism to find route. In this mechanism to find route it uses two packets RREQ route request packet is broadcasted to find route. RREP route reply to set up a forward path. The algorithm will be in three states (1) Router Coverage (2) Neighboring Mesh client (3) Backbone Network.

A. Router coverage – If mesh clients are within the coverage area of routers. Mesh clients use routers to communicate with gateway. Instead of using route discovery process of broadcasting RREQ packet and saving energy of mesh client.

B. Neighboring mesh client – If mesh client is not in the coverage area of mesh router. This coverage area is an area that must be covered by sensors. Each area must have sensors , as these sensors are randomly distributed. Mesh router sends route reply packet to discover route to gateway. Route-reply packet sent to multi-hop Ad hoc network .Ad hoc network provides network in areas where internetworking between devices is not possible such as disastrous prone environment. If in the sensor area or coverage node responds to route reply packet, then packet follows a reverse path to router.

C. Backbone network – In backbone network when many routers fail. Then clients forward data designing the algorithm.

V. Simulation Reaction and Performance Study

The proffer Reliable Routing-Hybrid Wireless Mesh Network (RR-HWMN) algorithm is practiced on the platform of Qual Net 5.0 to investigating a hybrid wireless mesh network managed in covered mine for the communication in special covered region needed for observation and necessity rescue. While conducting simulation the network consists of 25 mesh routers, 30 mesh clients, and a gateway, whichever remains irregularly distributed in a rectangular region of 2000 × 6 square meters scatted as a tunnel in underground mine. The superlative transmission range of nodes is 200 meters, and the simulation time is 400 seconds. The foremost energy of mesh clients is 10J and the energy consumption model manipulated in the simulation is the model in [12] for wireless communication hardware. The traffic model is Constant Bit Ratio (CBR) and the size of data packet to convey is 512 bytes. Taking into account the Hybrid Wireless Mesh Network (HWMN) in actual mine emergency rescue, the data grouped by mesh clients is predominantly directed over the gateway to the outward network, so the terminal of data stream developed by mesh clients is set as the gateway in the simulation. The duration of traffic is settled as 60 seconds and the transmission interval of data packet is 1 seconds. The purpose of constant bit ratio (CBR) irregularly starts and continues for a fixed

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duration, this composes the simulation contiguous to genuineness of underground mine and targets on the investigation of the energy consumption. Different algorithms are distinguished based on their performance such Reliable Routing-Hybrid Wireless Mesh Network (RR-HWMN) algorithm, power and node type aware routing algorithm (PNTARA) on energy performance and energy equity such as moderate remaining energy of mesh clients, disproportionate degree of remaining energy of mesh clients, and quality of service (QoS) metrics such as packet transmission ratio.

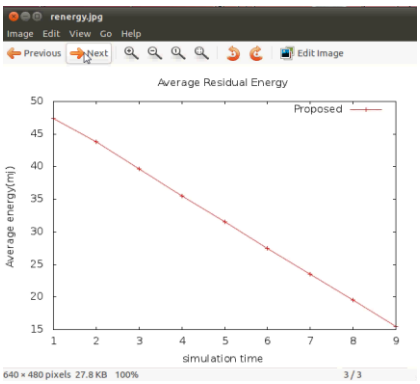
A. Energy Performance and result analysis

1) Moderate Remaining Energy of Mesh Clients

In Figure 3 shows that the moderate remaining energy of mesh clients declines haltingly with upgrade in number of mesh routers, just as the primitive mesh client exhausts its energy. The moderate remaining energy of mesh clients in Ad hoc on demand distance vector routing algorithm (AODV) is more advanced than that of power and node type aware routing algorithm (PNTARA) and Reliable Routing-Hybrid Wireless Mesh Network (RR-HWMN). In Ad hoc on demand distance vector routing algorithm (AODV), the hop count is used on the basis of route finding and the algorithm is organized not to consider particular energy supply nodes with different types such as ample amount of load, rapid energy utilization, and untimely energy reduction of mesh clients in the shortest path. Reliable Routing Hybrid Wireless Mesh Network (RR-HWMN) has defined an advanced energy cost criterion for mesh clients it fuses the energy utilized for data transmission and enduring energy of mesh clients into path cost calculation. The unsubstantial energy utilized for data transmission and more enduring energy of data sending node will lead to slighter energy cost and obtained the optimized combination of energy efficiency and energy balance. At the same time, Reliable Routing –Hybrid Wireless Mesh Network (RR-HWMN) diminishes the probability of the low-energy node deliver the data through the diverted strategy for low-energy nodes, which will further balance the energy utilization of mesh clients.

FIGURE 3: Moderate Remaining Energy

2) Disproportionate Degree of Remaining Energy of Mesh Clients



Here, the standard divergence of the residual energy in all meshes clients to analyze the amount of unequal proportion of residual energy. The energy utilized by mesh clients is unevenly balanced and the energy of nodes is quickly drawn when the value of unequal proportion of remaining energy of nodes becomes large. In Figure 4, the standard divergence of the residual energy of mesh clients in Reliable Routing – Hybrid Wireless Mesh Network (RR-HWMN) is lower than that of Power- and Node Type Aware Routing Algorithm (PNTARA) and Ad hoc on demand distance vector routing algorithm (AODV) this means that Reliable Routing – Hybrid Wireless Mesh Network (RRHWMN) has more desirable performance on energy balance therefore, it good that invention is made on newly designed energy cost criterion and avoiding strategy for low-energy nodes. At the beginning of the simulation, the remaining energy of mesh clients is the same and the standard divergence of residual energy is zero. Along with the data transmission, distinct mesh clients have different energy consumption, and unbalanced degree of residual energy of mesh clients increases. But the growth of Reliable Routing – Hybrid Wireless Mesh Network (RRHWMN) is slower than Power- and Node Type Aware Routing Algorithm (PNTARA) and Ad hoc on demand distance vector routing algorithm (AODV), and the value of the standard divergence is always lower than Power- and Node Type Aware Routing Algorithm (PNTARA) and Ad hoc on demand distance vector routing algorithm (AODV) presents suggestive effects on energy balance. In Power- and Node Type Aware Routing Algorithm (PNTARA), the remaining energy of mesh clients used to find out the path cost, is partitioned into three levels by setting the upper and lower threshold. But the residual energy in the same level may have many differences, which will affect the result of energy balance.

FIGURE 4:Delay graph

B. Quality of Service

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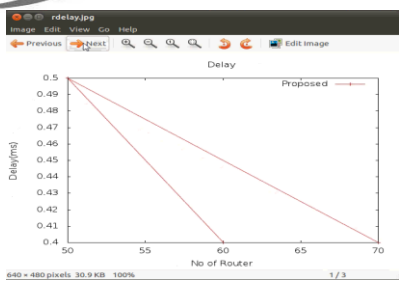

1) Packet Transmission Ratio

In Figure 5, the mesh clients with energy reduction in Ad hoc on demand distance vector routing algorithm (AODV), and the number of energy disabled nodes increases over the simulation time, so the packet delivery ratio (PDR) has downgraded. Reliable Routing – Hybrid Wireless Mesh Network (RR-HWMN) and Power- and Node Type Aware Routing Algorithm (PNTARA) have used the energy optimization strategy, the retarded time in which nodes with exhausted energy emerged, and decreased the number of nodes running out of energy. But the hop count of the route in Reliable Routing – Hybrid Wireless Mesh Network (RR-HWMN) and Power- and Node Type Aware Routing Algorithm (PNTARA) is more than that in Ad hoc on demand distance vector routing algorithm (AODV), which will increase the packet loss probability. So the Packet delivery ratio (PDR) in these three algorithms is basically the same in the beginning period of the simulation.

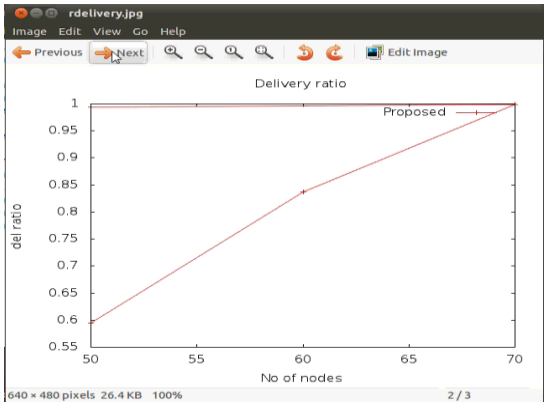

Figure 5: delivery ratio

VI. CONCLUSION

Mesh clients in hybrid wireless mesh networks (WMN) can partake to perform networking and routing this mends the connectivity and reliability of WMNs. In this paper a new concept studied is energy cost degree for mesh clients inspecting the energy consumption for data transmission and residual energy of data sending nodes. Therefore this paper has obtained the optimized amalgamation of energy efficiency and energy balance.

Future Enhancement

The future project is to constitute a real hybrid wireless mesh network in all destructive prone area by deploying mesh clients, mesh routers, and the gateway in the channel of mine.

REFERENCES

[1] A survey on routing algorithms for wireless Ad-Hoc and mesh networks.
[2] V. Mor and H. Kumar, "Energy efficient techniques in wireless mesh network".
[3] Sarra mamechaoui1 , fedoua didi2 and guy pujolle "A Survey On Energy Efficiency For Wireless Mesh Network"
[4] T. Al Hadhrami, Q. Wang, and C. Grecos, "Power- and node- type-aware routing algorithm for emergency-response wireless mesh networks".
[5] S. Wen, W. Fei, and D. Jianbo, "A emergency communication system based on WMN in underground mine," in *Proceedings of the International Conference on Computer Application and System Modeling (ICCASM '10)*, pp. V4624–V4627, October2010.
[6] T. Novak, D. P. Snyder, and J. L. Kohler, "Post accident mine communications and tracking systems," *IEEE Transactions on Industry Applications*, vol. 46, no. 2, pp. 712–719, 2010.
[7] Q. Zhu, X. Jiang, F. Zou, and S.Xu, "Improvement on multi-hop performance of underground mine emergency communication system based on WMN," *Journal of Computer Applications*, vol. 32, no. 3, pp. 800–803, 2012.
[8] Y. Zhang and W. Yang, "Nominal capacity of strip topology emergency rescue wireless mesh network for underground mines," *Journal of Huazhong University of Science and Technology*, vol. 40, no. 6, pp. 59–64, 2012.
[9] Y. Zhang,W. Yang, D. Han, and H. Zhang, "Topology design and resource allocation of emergency rescue communication networks for underground mines," *Journal of Huazhong University of Science and Technology*, vol. 41, no. 7, pp. 61–66, 2013.
[10] S. Avallone, "An energy efficient channel assignment and routing algorithm for multi-radio wireless mesh networks," *Ad Hoc Networks*, vol. 10, no. 6, pp. 1043–1057, 2012. [11] T. Al Hadhrami, Q. Wang, and C. Grecos, "Power- and node type- aware routing algorithm for emergency-response wireless mesh networks," in *Proceedings of the IEEE 77th Vehicular Technology Conference (VTC Spring '13)*, pp. 1–5, IEEE, June2013.
[12] W. B.Heinzelman , *Application-Specific Protocol Architectures for Wireless Networks*, Massachusetts Institute of Technology, 2000.

 doi : 10.17950/ijer/v5i4/014