WS-OLSR: MULTIPOINT RELAY SELECTION IN VANET NETWORKS USING A WINGSUIT FLYING SEARCH ALGORITHM

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ABSTRACT

The routing protocol is considered the backbone of network communication. However, mobility and bandwidth availability make optimizing broadcast message flooding a problem in an Optimized Link State Routing (OLSR)-based mobile wireless network. The selection of Multi-Point Relays (MPRs) has lately been proposed as a potential approach that has the added benefit of eliminating duplicate re-transmissions in VANET networks. Wingsuit Flying Search (WFS) is one of the swarm intelligent metaheuristic algorithms, it enables one to find the minimum number of MPR. In this study, a novel methodology based on (WFS) is called WS-OLSR (Wingsuit Search-OLSR). The (WS-OLSR) is investigated to enhance the existing MPR-based solution, arguing that considering a cost function as a further decision measure will effectively compute minimum MPR nodes that give the maximum coverage area possible. The enhanced MPR selection powered by (WFS) algorithm leads to decreasing MPR count required to cover 95% of mobile nodes, increasing throughput , and decreasing topology control which mitigates broadcasting storm phenomenon in VANETs.

KEYWORDS

OLSR, WS-OLSR, MPR selection, Wingsuit Flying Search, VANETs, Broadcast Storm Problem.

1. INTRODUCTION

Vehicular Ad-Hoc Networks (VANETs) is a new developing wireless technology concept that supports communication amongst various nearby vehicles to vehicles and enables vehicles to have access to the Internet [1]. In VANETS, there are still several interesting areas. Such as medium access control, routing protocols, and security, which lack large amounts of study. There is also a miss of freely available simulators that can rapidly and accurately simulate VANETs [2].

The number of vehicles in today's cities has increased, resulting in increased traffic, which has resulted in an increase in the number of traffic accidents. This is where VANET networks come into play, with the purpose of decreasing and attempting to avoid such accidents [3].

The Mobile Ad-hoc Network (MANET) is a kind of Vehicular Ad-hoc Network (VANET). VANETs are independent, wireless, and have no infrastructure. The vehicles of a VANET serve as mobile nodes that organize and configure themselves, and they can share information amongst themselves [4]. These networks are intended to minimize the risk faced by drivers and passengers while on the road [5]. Therefore, they are essential for implementing various field applications, such as intelligent transportation and intelligent cities [6], which may bring us many benefits,

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such as the development of traffic in cities through-traffic lights and smart virtual intersections that help reduce travel time and fuel consumption [7].

Naturally, vehicles must co-operate when relaying messages over a vast area. Whether these messages are transmitted and received effectively depends on multi-hop retransmissions [8][9]. Problems known as a broadcast storm can arise when the network does not have sufficient bandwidth to handle the number of messages being broadcast. The excessive routing associated with broadcast storms brings about significant increases in packet collisions and contention [10].

In VANETs, the mitigating broadcast storm problem represents one of the main challenges for researchers [11]. Researchers have discussed this issue, taking many different approaches like linear programming optimization for VANETs, and stochastic routing to efficiently navigate vehicles [12]. Dedicated Infrastructure to support VANETs has also been researched and led to further integration between VANETs and techniques to ensure better communication and fewer less congestions [13]. Congestion control in VANET is investigated intensively using different approaches like topology algorithms and power control algorithms with different metrics such as CBR, and IPD as performance indicators. Results have suggested that hybrid techniques such as combined Tx power and rate control are promising [14].

OLSR is an acronym for (Optimized Link State Routing) protocol is the pro-active routing protocol are using to establish a path between nodes of the network. These protocols are dependent on a routing procedure that is primarily based on the MPR (Multi Points Relay) selection of the technicality that order to minimize a network traffic load and else the road to the destination [15] [16]. The MPR-s search method, initiation by an NPC (Node Per-forming the Computation), enables it to assort the group of many nodes capable of sending and receiving the messages and the data for nodes outside its range, herewith covering the whole network. The calculations of this MPR using the standard algorithm RFC-3626 outlined below remain simplistic and deficient because it doesn't account for all node's characteristics. To conduct a deep examination of this issue, we compare numerous methods proposed by researchers to enhance the service quality [17] [18] and the security level [19] [20] of these protocols against the attack. [21][22].

In this paper, a new approach called Wingsuit Search-Optimized Link State Routing Protocol (WS-OLSR) optimized protocol can be used to control broadcast storms through optimized routing. By reducing control and topology messages and transferring data through a minimum count of nodes in a minimum count of hops. Section 2 described the related works. Section 3 presents some main issues that need to be understood in VANETs. Section 4 describes the proposed methodology and the pseudo algorithm of (WS-OLSR). Section 5 provides the detailed parameters and simulation setup while the results evaluation and discussion are provided in Section 6. Lastly, the conclusion will be in Section 7.

2. RELATED WORK

The necessity first algorithm (NFA) was used to select MPRs. In comparison to the greedy algorithm [23], the results of the reformation using the OPNET showed that the planned algorithm will decrease the sum of TC and MPR from 0.7% to 11.2%. PDR, throughput, latency, and power usage, on the other hand, were not evaluated.

Another research study proposed two methods for lowering and stabilizing the MPR: universally optimizing MPR selections and retraining MPRs [24]. The OMNET simulation results illustrate that their method dramatically recovers OLSR efficiency. PDR, throughput, latency, and power usage, on the other hand, were not evaluated.

A local database of surrounding nodes was proposed by the researchers, which could be extended in 3 hops [25]. The MPR choice seeks to minimize the TC packet overhead by identifying the nearby subset of the MPR. Due to the sum of TC packet, costs, and routing performance, the replication consequences of the NS2 showed that the OLSR variants outperform the normal OLSR.

Centered on powerful broadcasts over wireless ad hoc networks, another approach is to add more MPR nodes. The planned approach chooses another MPR node so that 2 MPR hopping nodes can be found [26]. The number of extra MPR nodes is calculated using mathematical modeling and simulation. Also, the simulation findings demonstrate that the suggested strategy can betterthe throughput and delivery ratio when compared to a regular OLSR. Dynamic ecological conditions, on the other hand, have not been evaluated.

In [27], the selected multi-point relay kinetics (KMPR based on mobility predictions) was investigated. Simulation findings with NS2 showed that the planned KMPR approach can decrease overhead (RO) and delays when compared to the norm OLSR. Parameters such as packet surrender ratio, throughput, and energy consumption, on the other hand, were not evaluated.

In wireless OLSR ad hoc networks, MPR choice, using the extended MPR (EMPR) principle, has been investigated [28]. In MPR elections, the value of the cost is taken into account by EMPR as an additional element. The recommended EMPR definition provides a larger coverage area for the MPR ensemble than the MPR-based OLSR heuristic. On one hand, the outcomes of the OPNET simulation show that EMPR will reduce the value of packet loss depending on the rapid changes. However, the evolution of parameters such as PDR, throughput, delay, and energy efficacy wasn’t evaluated.

EOLSR (Energy Efficient Optimized Link State Routing), an MPR chosen method based on residual energy, was investigated by [29]. The EOLSR process is the OLSR several in which an energy level and the number of neighbouring nodes are used to determine the MPR selected and path calculations. The simulation results indicate that the EOLSR method has the potential to significantly reduced residual energy in more numbers of nodes. However, the PDR, throughput, packet loss, and delay parameters haven’t been evaluated.

3. ISSUES AND PROBLEMS IN VANETS

3.1. Routing Protocols in VANETs

Routing protocols govern communication and information exchange between two nodes. In the VANET networks, routing protocols are close to MANET technology. VANET and MANET environments are not the same; MANET has less mobility than VANET because VANET routing makes high mobility difficult. Routing protocols are classified into two groups based on topology and geographic position [30].

In topology-based protocols: Routing tables are used to send data packets from the source to the destination node [31]. Reactive, Proactive, and hybrid routing protocols are the three kinds of topology-based routing protocols [32][33].

While with geographical routing each node knows its location by utilizing GPS or any other indirect localization approach [34].

3.2. Broadcast Storm Problem

Broadcasting is a method of communication between network nodes, in which one node sends a message packet to all its neighbours [35]. Since other network protocols and applications depend on broadcasting facilities, it is a critical and central networking activity [36].

One of the main wireless network features is to link plenty of nodes to increase coverage by utilizing switch and router forwarding mechanisms. However, when all the linked nodes return the received packets without any central control, the network becomes congested, which is regarded as the problem of the broadcast storm[37][38].

Using a more adequate routing protocol can mitigate the broadcasting storm problem by better-selecting nodes that broadcast messages over the network, which contributes to decreasing collisions and messages over flooding.

Later, a novel modified version of the OLSR routing protocol based on the Wingsuit Flying Search algorithm has been investigated in detail for the purpose to optimize node selection in VANET networks, aiming to reduce the count of total relay nodes that broadcast control messages over the widest area possible occupied by a VANET network.

3.3. OLSR Protocol

According to [39], “OLSR is an ad-hoc network proactive routing protocol, OLSR consists of four main principles such as neighborhood sensing, message flooding, topology information, and path computation. which keeps a network topology view on each node and offers a route as soon as it's required [40]. Furthermore, it employs the Multi-Point Relay (MPR) principle to reduce control traffic and offer the shortest paths (in terms of hops) to all network destinations. Each node selects a subset of nodes in its neighborhood as its MPR – an MPR set is thus relative to each node – and retains track of the neighbors who have elected themselves as an MPR. The shortest route to all potential destinations is then calculated from these lists, a route between two nodes being a sequence of MPR. When obtaining a broadcast message ‘M’ from a node ‘u’, a node ‘v’ posts it, if it is the first time ‘v’, gets ‘M’ and, if node ‘v’ is the MPR of node ‘u’. This permits the reduction of the number of transmitter nodes. The algorithm which permits a node ‘u’ to select its MPR, elect nodes in its neighborhood in such a way that the whole 2-neighborhood of ‘u’ is enclosed by its MPR. MPR was chosen such that the 2-neighborhood of ‘u’ is reached in two hops from ‘u’, and the k-neighborhood ‘u’ is attained in ‘k’ hops”. As a result, the paths are expected to be the shortest.

3.4. MPR Selection

Here, we present a commonly used method [39] for optimal **MPR** selection: “The Greedy **MPR** Heuristic. Let **N (u)** be the neighborhood of a node **u**, which is a node that:

- The set of nodes in the u's range.
- Shares a bidirectional link with **u**, (equation 1):

$$\boldsymbol{v} \in \boldsymbol{N}(\boldsymbol{u}) \Leftrightarrow \boldsymbol{u} \in \boldsymbol{N}(\boldsymbol{v}) \tag{1}$$

The neighborhood of **u** is **N2 (u)**, that is the set of neighboring nodes of at least one node of **N (u)** but not of **N (u),** (equation 2):

$$\boldsymbol{N_2}(\boldsymbol{u}) = \{\boldsymbol{v}\ \boldsymbol{s.t.} \exists \boldsymbol{w} \in \boldsymbol{N}(\boldsymbol{u}) | \boldsymbol{v} \in \boldsymbol{N}(\boldsymbol{w}) \backslash \{\boldsymbol{u}\} \cup \boldsymbol{N}(\boldsymbol{u})\} \tag{2}$$

A message sent by node **u** and relayed by a node **v** ∈ **N(u)** reaches a node **w ∈ N2(u)** ∩ **N(v)** in **2hops**.

For a node **v** ∈ **N(u)**, let $\boldsymbol{d_u^+}\ (\boldsymbol{v})$ be the number of nodes of **N2 (u)** that are in **N (v),** (equation 3):

$$\boldsymbol{d_u^+(v) = \{N2(u) \cap N(v)\}} \tag{3}$$

This quantity is the number of nodes of **N2(u)** that node **u** can reach in **2 hops** via node **(v)**. For a node **v ∈ N2(u)**, let $\boldsymbol{d_u^-}\ (\boldsymbol{v})$ be the number of nodes of **N (u)**

which are in **N (v)**, (equation 4):

$$\boldsymbol{d_u^-(v) = \{N(u) \cap N(v)\}} \tag{4}$$

This quantity is the number of nodes in **N(u)** which allow the connection of nodes **u** and **v** in **2 hops**.

If, (equation 5):

$$\boldsymbol{d_u^-(v) = 1} \tag{5}$$

There is only one node **w** in $\boldsymbol{N(u) \cap N(v)}$ which allows to connecting **v** and **u** in **2 hops**. We say that **v** is an isolated node of node **u**. Note that "isolated nodes" are also relative to a node. The Original algorithm is run at every node and selects the **MPR** in two steps.

In equation 6, a node **u** selects in **N (u)**, a set of nodes that integrally covers **N2(u)**. We define as **MPR(u)** this set of **MPR** selected by **u**. **MPR(u)** is such that:

$$\boldsymbol{u \cup N2(u) \subset \bigcup_{v \in MPR(u)} N(v)} \tag{6}$$

We call **MPR1(u)** ⊂ **MPR(u)** the nodes that **u** selects at the first step. **(u)** selects as **MPR1(u)** the nodes which cover its isolated nodes. **MPR1(u)** is thus the only way to reach isolated nodes of **u** in **2 hops** from **u**.

Thus, the first step is mandatory to cover **N2(u)** with **MPR(u)**.

In the second step, **u** considers the nodes in **N2(u)** not already covered by the **MPR1 (u)**. It chooses as **MPR** the node of **N(u)** allowing to cover the maximal number of uncovered nodes of **N2 (u)**, and so on till getting **N2(u)** all covered".

The present standard method of **MPR** selection has the following disadvantages:

- Every node selects an MPR set based on a highly connecting node to a the 2-hop neighbor. Therefore, the node which has the higher connectivity will be selected as MPR by many nodes and the node with the lowest connectivity to 2-hop neighbour will be selected by fewer or will not be selected by any node. This diverts major traffic to a high connectivity direction leading to congestion.
- The energy of the MPR node will be consumed faster due to excessive demand to relay the transmission of neighbor nodes while another will preserve its energy leading to misbalanced

overall power consumption and the network connectivity will be badly affected in terms of bandwidth availability and delays.

An adequate MBR selection to achieve shortest yet location-optimized routes are the key to reducing traffic, especially unnecessary communication between a node to avoid congestion and power loss. So, finding a better way to select the MBR in every hop to be located inside a better spatial conformation, would reduce the number of relay nodes and shorten routes. For that reason, the Wingsuit Flying Search algorithm will be discussed as a promising technique for a better MBR system.

3.5. Wingsuit Flying Search Algorithm (WFS)

The (WFS) is a novel optimization method inspired by extreme sports like "Wingsuit Flying" which is done by certain amateurs at high altitudes [41]. The method replicates a pilot's desire to land at the lowest point on the Earth's surface within their range i.e., the search space's global minimum. At each iteration, this is performed by probing the search space with a carefully selected population of points. While the population is iteratively updated, the flier eventually receives a sharper image of the surface, shifting attention to lower regions.

The algorithm is basically a population-based search that renews the set of possible solution points iteratively. After selecting a set of initial points, a cost function is applied to the set. The set of the next iteration is calculated from neighbor points of points that produce the lowest values of the desired cost function, and so on.

WFS is a relatively simple algorithm to use since it demands only the population size and the maximum number of iterations. Additionally, it is overly simple to implement due to its structural simplicity.

Although the standard OLSR protocol has many advantages in controlling congestions, but in many situations it fails to achieve a smooth control over congestion due to many reasons such he nature of messaging system and the algorithm that selects MPRs.

So, we introduce in this research a new version of OLSR protocol named WS_OLSR, aiming to better calculate MPRs to optimize its spatial allocation and reduce their numbers to mitigate congestion and maximize coverage area.

The particular novelties inducted in (WS-OLSR) proposed can summarize in:

- This is the first use of the Wingsuit Flying Search (WFS) algorithm as a swarm intelligent metaheuristic in VANET, and it is a promising approach, according to our implementation and simulation
- (WS-OLSR) will enhance OLSR methodology to find a minimum hop count towards the destination benefiting from (WFS) algorithm, which leads to less traffic by reducing control messages density.
- The second target will lead to mitigating broadcast storms in VANETs.

4. OPTIMIZING "OLSR" PROTOCOL USING WFS

To select MPRs that maximize the coverage and minimize the number of required MPRs during flooding, both RSS (Received Signal Strength) as a reachability metric and AoA (Angle of Arrival) as a coverage metric are used.

We introduce a new cost function as an additive factor when calculating MPR1 and MPR2 for any selected node using the method mentioned previously. Let's assume the following:

- There is a fixed station that has the capability of measuring AoA to any moving node and acknowledging this node of this AoA value as shown in figure 1, we denote this angle as θ.

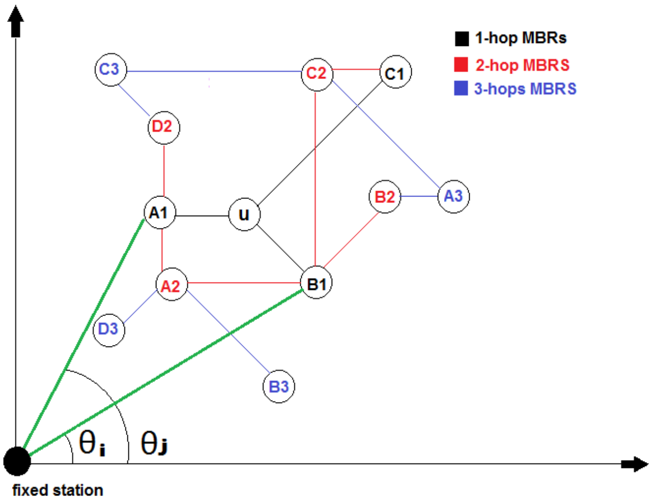

Figure 1. Fixed station

- For any given node u, messages should be delivered to any destination node directly and that is a one-hop path or using one relay node and that is a 2-hop node, and so on.
- Every node has the capability of measuring RSS values to all N1 neighbors (that shared a bidirectional link). We denote RSS as r.
- Let αi,j be the subtraction of arrival angles (equation 1) calculated between every 2 nodes (i, j) of N(u),:

$$\propto_{i,j} = \theta_j - \theta_i : i,j \in N(u) \tag{1}$$

Then we can define the following cost function:

$$f_c(\propto, r) = (w^1 \left|\sum_{i=1}^{n} r_i\right| - w^2 \sum_{\forall i,j \in N(u)}^{C_2^n} \propto_{i,j}) \tag{2}$$

Where:

W1 = W2=1: When calculating 1-hop neighbours of a node u(N1(u)).
W1=1.5, W2=0.5: When calculating 2-hop neighbors of a node u(N2(u)).

Minimizing FC (equation 2) using the wingsuit algorithm will result in a set of nodes with desired characteristics in each iteration, then the real nodes will be estimated by a simple fitting step.

An additional step will be considered after executing the Algorithm to choose an adequate number of nodes with negative and positive values of arrival angles subtracts to ensure a fair distribution of MPRs.

Wingsuit-based MPR calculation pseudo algorithm (WS-OLSR)

```
//define wingsuit algorithm initial values and limits in terms of RSS and arrival angel
Input: n, $\alpha$, r, [$\alpha_{min}$, $\alpha_{max}$],$\Delta\alpha_{min}$, [$r_{min}$, $r_{max}$], $\Delta r_{min}$
// expected output will be the best number of relay points and the best cost function value
Output: $n^*$, $f^*$
// assigning the initial values for inputs.
n←500
[$\alpha_{min}$, $\alpha_{max}$]←[0,π]
[$r_{min}$, $r_{max}$]← [50,90]
$\Delta\alpha_{min}$←0.25
$\Delta r_{min}$←5
//iterating wingsuit algorithm calculations to find out the desired output.
Fori=1 to iterations count
…Calculating $\alpha$, r
…Calculating FC
…Getting nodes for the next iteration (nodes having lowest values of Fc)
…fitting calculated nodes to existing nodes
…updating the set of nodes for the next iteration
Next
```

5. SIMULATION SETUP

OLSR is a gauge simulation analysis and wingsuit search-optimized OLSR (WS-OLSR) is completed based on several 1-hop MPRs count, 2-hop MPRs count, throughout and topology control using the Wingsuit Flying Search. The simulation result, using an NS3 discrete event simulator, provides a conclusion about the execution for a gaugeOLSR, and WS-OLSR utilizes a Wingsuit Flying Search. Table 1 shows the simulation parameters.

Table 1. Simulation parameters

Parameters	Description
Network Simulator	NS 3.29
Operation System	Ubuntu 18.04
Routing Protocols	Standard OLSR and WS-OLSR
Number of Nodes	25-200
Radio Propagation Mode	Two dimensions' ground
Transport Protocol	UDP
Packet Size	512 bytes
MAC Protocol	IEEE 802.11
Mobility Model	Random Waypoint
Simulation Time	200 seconds
Simulation Area	1000 m x 1000 m
Fixed Speed	20 m/sec

As we have stated previously that reducing the count of total relay nodes that broadcast control messages over the widest area possible occupied by a VANET network would reduce TC messages and regulate loads over the network leading to less congestion status, simulation has focused on the 1-hop MPRs count accompanied by the throughput to manifest the ability of WS-OLSR protocol to evenly distribute MBRs, while the lower 2-hop MPRs count would be related to minimal TC messages.

6. WS-OLSR PERFORMANCE EVALUATION

6.1. Number of MPRs

One-hop MPR for a node u is a node set in the range of u, which shares a direct link with it and can relay its messages to another node. Less number of well-distributed 1-hop MPRs can sufficiently reduce TC messages and mitigate over flooding. The simulation showed that using wingsuit-optimized OLSR can reduce 1-hope and 2-hope MPRs required to cover 95% of mobile nodes by about 15%–20% as shown in figure 2.

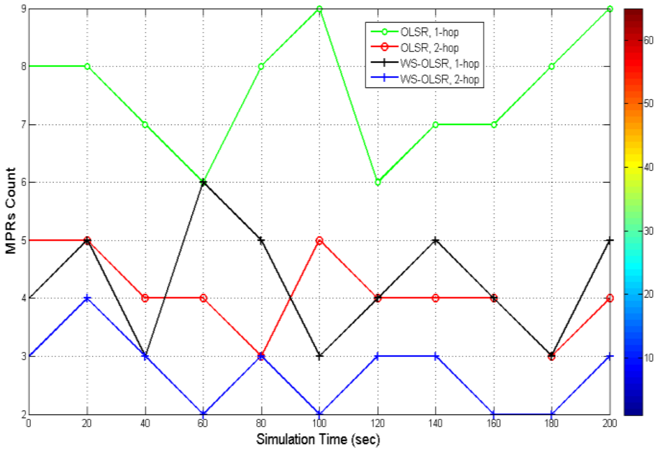

Figure 2. WS-OLSR MPRs Count (1-hop, 2-hop)

Figure 2 shows the number of relay nodes that the vehicle had to register during the simulation period. As mentioned earlier, during this period, the vehicle may cross the studied area several times, and therefore the network topology will change, increasing or decreasing the number of nodes eligible to deliver messages. But what distinguishes the new algorithm is that the number of nodes needed to transfer messages to the target node or vehicle through two loops (2-hops) is the least possible compared to the traditional OLSR algorithm with two loops. This will have a significant impact on reducing congestion due to the low number of participating nodes in delivering data to the target node.

6.2. Throughput

It is the definition as the overall number of packets successfully received in units of time multiplied by the rate of effective data transferring in Bytes Per Second (Bps). As the throughput grows, so does the routing protocol's efficiency. For the sum of different nodes, figure 3 displays the output of the OLSR and the OLSR utilizing the wingsuit algorithm. On deeper nodes, such as nodes 150 and 200, the OLSR throughput output using the wingsuit algorithm is more stable. The standard OLSR's throughput performance is unstable and declines as nodes become denser, particularly at node 200. OLSR using the wingsuit algorithm outperformed the competition.

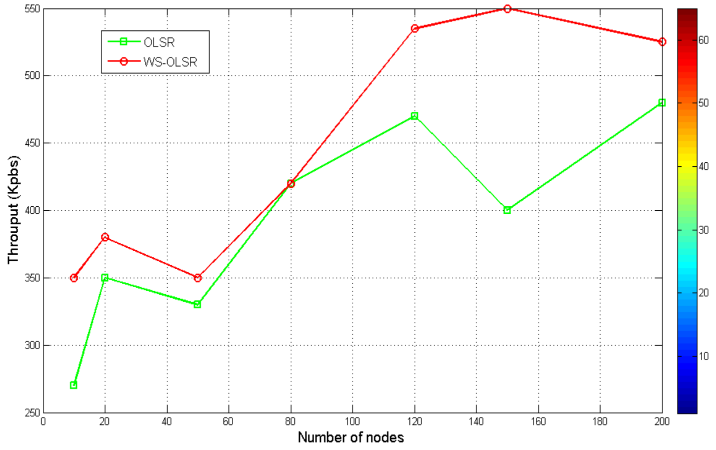

Figure 3. The throughput rate of WS-OLSR compared to OLSR

Although the result is encouraging, we must later perform a simulation process to estimate the average channel capacity per user achieved by WS-OLSR when operating in a crowded or fading environment as suggested in [42] for better examining the proposed algorithm.

6.3. Topo-logy Control (TC)

TC assumes the full amount for routing packets submitted throughout the experiment. Packets sent through multiple hops were treated as a single trans-mission (one hop). Figure 4 shows the TCs on OLSR and standard OLSR uses a wingsuit algorithm dependent on the number of different nodes. At nodes 25 to 100, TC movement on OLSR using the wingsuit algorithm appears to increase. Denser nodes, on the other hand, appear to have fewer TC values, particularly at nodes 150 and 200.

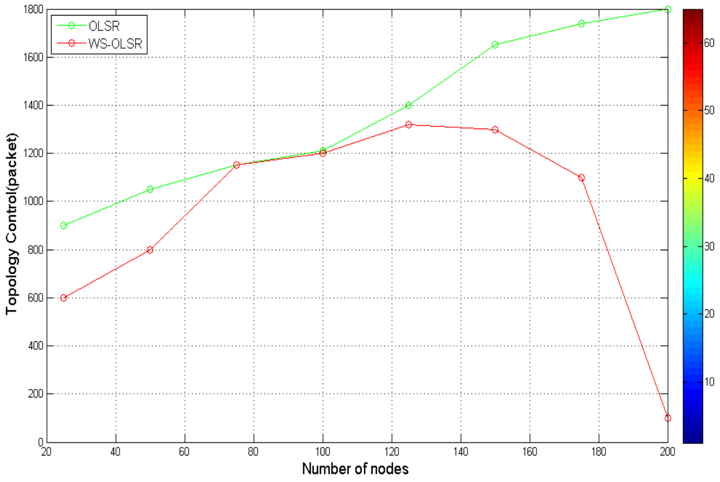

Figure 4. TCs of WS-OLSR compared to OLSR

6.4. Results and Discussion

Simulation has been performed under some fixed conditions such as transport protocol (UDP), MAC protocol (IEEE 802.11), and node speed (20 m/s). Results have indicated that WS-OLSR reduced TC messages by 10-40% on average accompanied by an increase in throughput by 20-30% obviously as a direct outcome of reducing MBRs count. Better results in terms of throughput and TC control messages are achieved when the total node count is high (60 nodes per 1 Km2) due to better conditions to apply the Wingsuit Flying Search algorithm, which works better when the initial population is high enough, and a better spatial distribution of MBRs.

Using a Wingsuit Flying Search algorithm was less effective when the total node count was not high enough as a result of limitations in applying the algorithm, which itself is in continuous development progress.

The result of the simulation in general shows a significant decrease in the amount of service and control message which suppresses broadcasting storm phenomenon, that was obvious in terms of higher “package delivery rate” values. 1st and 2nd hop MPRs selection process is optimized in terms of total number and spatial distribution without any noticeable negative effects on network performance like throughput.

Using Wingsuit fly search algorithm in optimizing MPR selection in OLSR protocol yields a more robust algorithm (WS-OLSR) that can mitigate the broadcasting storm problem effectively.

7. CONCLUSIONS

The current paper suggests the Wingsuit Flying Search enhances OLSR through a better method of calculating MPR. Applying this method to the OLSR protocol has led to a modified version of this protocol called WS-OLSR. The execution for standard OLSR and Novel WS-OLSR has been analyzed based on the number of 1-hop MPRs count, 2-hop MPRs count, and throughput and topology control. The simulation results show that the Novel WS-OLSR protocol can reducethe MPR count required to cover 95% of mobile nodes, increase throughput, and reduce TC compared to standard OLSR which mitigates the broadcasting storm phenomenon in VANETs significantly.

Using a Wingsuit Flying Search algorithm was less effective when the total node count was not high enough as a result of limitations in applying the algorithm, which itself is in continuous development progress. Besides that, many performance parameters must be examined carefully, especially when vehicles move faster than 20 km/h which is the speed we used in the research.

More studies should be performed later as future work concerning:

- Changing transportation and MAC protocols.
- Applying enhanced versions may appear later in the Wingsuit Flying Search algorithm.
- Study WS-OLSR protocol on highways VANETs to test its capabilities at higher speeds.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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