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Optimal Intelligent Vehicle Control System for Emergency Vehicle Using Visible Light Communication VANET

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Abstract: Traffic congestion is one of the significant problems in every metropolitan city. Traffic congestion occurs, when large numbers of vehicles are all together and are not able to move or move slowly, it is also known as a traffic jam. The main aim of the proposed OIVC-VLC VANET system is to improve the data transmission rate to control traffic in high density loads for emergency vehicles. Traffic congestion leads to wasting of time, road accidents, delays of trips, and reduces regional economic health and fuel consumption. Moreover, the most critical concern of traffic congestion is a delay of emergency vehicles like ambulance and police vehicles, and firefighting trucks leading to an increase the human death and loss their essential things. In addition, this paper focuses to reduce the traffic congestion and traveling time of emergency vehicles. To overcome traffic congestion issues, an Optimal Intelligent Vehicle Control System for the emergency vehicle by intelligent traffic clearance (OIVC-VLC-VANET) is proposed. Firstly an improved whale optimization (IWO) algorithm is submitted for grouping the vehicle nodes based on their behaviors. Secondly, the differential search algorithm is used to select the next forwarding node using multiple constraints received from vehicles. Thirdly, the dragonfly algorithm is submitted for avoiding extra time due to the control packets exchange process. The results show that the proposed OIVC-VLC-VANET system can perform very efficiently in terms of quality constraints than existing systems.
Keywords: OIVC, Improved Whale Optimization, Differential Search Algorithm, Dragonfly Algorithm, Traffic Congestion.

I. INTRODUCTION

The serious issue is traffic congestion in urban communities of creating Countries like India. Development in urban populace and the working class fragment devouring vehicles fundamentally to the rising number of vehicles in the urban communities [1][2]. congestion on streets in the long run outcomes in moderate moving rush hour gridlock, which builds the hour of movement, along these lines stands-apart as one of the significant issues in metropolitan urban areas [3]. Along these lines, there is death toll because of the postponement in the appearance of rescue vehicle to the medical clinic in the brilliant hour. The fundamental explanation is that traffic sign are utilized to oversee clashing necessities for the utilization of street space frequently at street intersections by allotting the correct side of an approach to various arrangements of commonly good traffic developments during particular time interims [4]. Current traffic control method including attractive circle finders covered in the street, infrared and radar sensors as an afterthought give restricted traffic data and require separate frameworks for traffic tallying and for traffic observation [5]. Inductive circle indicators do bear the cost of a savvy arrangement, however they are center to a high disappointment rate when introduced in broken street surfaces, decline roadway life and square traffic during support and reestablish. Infrared sensors are influenced to a more noteworthy degree by perplexity than camcorders and can't be utilized for successful perception. In look at, video-based frameworks offer numerous points of interest contrasted with conventional systems [6]. They give more traffic data, blend both observation and traffic control strategies, are effectively introduced, and are adaptable with advancement in picture handling methods [7].

Emergency vehicles, similar to fire engines, squad cars, and ambulances hold glimmering lights and a noisy alarm to inform drivers and people on foot out and about. A large portion of the private vehicles have the cassette deck that tops off within the vehicle with sound. Consequently, the alarm of the crisis vehicle is out of earshot to the driver of the private vehicles [8]. There are a few episodes happening each day and EV needs to react and reach in time with insignificant postponement. The way and course they pursue must be clear so they don't need to remain in path and hang tight for the traffic. A vehicle-to-vehicle following framework [9] depends on noticeable light correspondence utilizing a CMOS sensor camera. Ideal arrangement of noticeable light correspondence (VLC) - based UAVs gives both enlightenment and correspondence.

A two-advance methodology is utilized to take care of the issue can be isolated as a littlest encasing plate issue and a min-size bunching issue [10]. The two arrangements of models where the first depends on the broadcast communications instructional displaying framework, which is an instructive demonstrating and measured prototyping method that is generally utilized for structure instructive correspondence frameworks [11]. A handover plan is utilized for indoor microcellular VLC organize [12], which is completely inclusion by light, is isolated into a few microcells as indicated by the design of LEDs. Probably the most ideal approaches to adapt to each one of those issues is by following the way of the vehicles running out and about and by anticipating the way they would follow further. This should be possible by Installing a "TRACKER SYSTEM" in every one of the vehicles. It is gadget which can be incorporate with any vehicle and give its area by GPS(Global Positioning Service) and odometer information.

It utilizes any most recent microcontroller, for example, AVR (At mega) or Arduino and GPS module and a program facilitated on server[13]. The utilization of EV by creating vitality proficient directing instruments. To conquer the self-sufficiency restriction, This structure for the EV (ELECTRIC VEHICLE) directing issue with energizing stage(s) en route on the accessible charging stations[14].The RFID traffic control keeps away from issues that typically emerge with standard traffic control frameworks, particularly those identified with picture preparing and shaft interference systems. This RFID system manages a multivehicle, multilane, multi street intersection territory. It gives a productive time the executives conspire, in which a powerful time calendar is worked out progressively for the entry of each traffic segment. The constant activity of the framework imitates the judgment of a traffic police officer on obligation. The quantity of vehicles in every section and the steering are decencies, whereupon the computations and the decisions are based[15].The ETL (Emergency Traffic Light) control framework give a smooth stream to crisis vehicles, for example, ambulances to arrive at their goals in time and in this manner limiting the postponement brought about by roads turned parking lots. The ETL control framework will control the traffic lights in the way of the crisis vehicles, halting clashing traffic, and permitting the crisis vehicle option to proceed to help in lessening their reaction time[16][17].A epic traffic light acquisition calculation dependent on preparing some portion of the Cooperative Awareness Messages (CAM) effectively characterized in the alleged European Intelligent Transportation System (ITS) correspondence engineering to limit the likelihood of mistake in rush hour gridlock preemption[18].Combination of traffic light foundation with Dedicated Short Range Communication (DSRC) over IEEE 802.11p to address a difficult issue, mishaps containing crisis vehicles at crossing points. In AEVGL, use correspondence to preemptively switch traffic lights to red for intersection traffic to permit safe section of the moving toward crisis vehicle even in low correspondence infiltration situations [19].Li-Fi can be utilized to actualize Vehicle to Vehicle (V2V) correspondence as it has numerous preferences over other correspondence conventions. One of the primary points of interest of Li-Fi is that it gives availability inside an enormous region with greater security and higher information rates. Crisis vehicles, for example, Ambulances, Firefighting trucks, Police vehicles and so on can proliferate quicker through traffic-thick streets utilizing Li-Fi based V2V correspondence framework [20]. In vehicular ad hoc network (VANET), lots of information should be delivered on a large scale in a limited time. Meanwhile, vehicles are quite dynamic with high velocities, which causes a large number of vehicle disconnections and leads to unreliable information transmission in VANET. A vehicle clustering algorithm, which organizes vehicles in groups in VANET to improve network scalability and connection reliability [21]. Vehicle to Everything (V2X) communication capability has drawn the attention of various government agencies, industries, and research communities to implement the Vehicular Ad hoc Networks (VANETs) in real-time. Excellent results have been yielded for the ephemeral nature of communicating cars in the VANET domain, aiming to provide safety in emergencies. A systematic analysis for selecting the relevant criteria for clustering in VANETs and effectively validating new designs and promoting VANET technology towards deployment is crucial[22].

Contributions of this paper are:

A Visible light Communication based Optimal Intelligent Vehicle Control System for emergency vehicle by intelligent traffic clearance (OIVC-VLC-VANET) is proposed. Initially we propose improved whale optimization (IWO) algorithm for grouping the all vehicles depends upon theirs behaviors. Then we propose differential search algorithm for select next forwarding node using multiple constraints received from vehicle and finally, for avoiding extra time due to the control packets exchange process, we propose and using the dragonfly algorithm. Comparing with previous method, the proposed OVIC system performs very efficient in terms of quality constraints than existing method.

The manuscript is organized as pursues: In part I, we expressed analysis of various techniques of optimal intelligent vehicle control system for emergency vehicles. In part II explains the issues optimal intelligent vehicle control system for emergency vehicles using light communication networks assume on illustrative example, In addition, we analyzed problems of previous methods and system model pursues section III. We illustrated about proposed algorithm in part IV and in

part V we discuss implementation aspects and results. We outline the major conclusions of this paper in section IV.

II. RELATED WORKS

There are lots of researches have been presented in optimal intelligent vehicle control system for emergency vehicles. Some latest research relevant to optimal intelligent vehicle control system for emergency vehicles using light communication networks using variety techniques are listed below:

Subash Humagain et.al[23] Analyzed reducing the travel time of emergency vehicles (EVs) in an effective way to improve critical services such as ambulance, fire, and police. A route optimisation and pre-emption technique reduces the travel time of emergency vehicles (EVs). It presents a systematic literature review of optimization and pre-emption techniques for routing EVs. A detailed classification of existing techniques is presented along with critical analysis and discussion. The study observes the limitations of existing routing systems and lack of real-world applications of the proposed pre-emption systems, leading to several interesting and important knowledge and implementation gaps that require further investigation. These gaps include optimizations using real-time dynamic traffic data, considering time to travel as a critical parameter within dynamic route planning algorithms, considering advanced algorithms, assessing and minimizing the effects of EV routing on other traffic, and addressing safety concerns in traffic networks containing multiple EVs at the same time.

Angela et.al [24] have exhibited, a urban system of signalized convergences can be appropriately demonstrated as a cross breed framework, in which the vehicle stream conduct is depicted by methods for a period driven model and the traffic light elements are spoken to by a discrete occasion model and it center a model of such a system through crossover Petri nets is utilized to state and take care of the issue of planning a few traffic lights with the point of improving the presentation of certain classes of unique vehicles, i.e., open and crisis vehicles. This model information has been approved utilizing genuine traffic information significant to the city of Torino, Italy.

Andrea's et.al [25] have exhibited, one regularly referred to utilize case for vehicular systems are applications that identify with crisis vehicles. Notwithstanding the customary alarm, they could utilize radio correspondence to caution different vehicles or to seize traffic lights. Such an application can lessen mishap dangers during crisis reaction outings and furthermore help spare significant time. We diagram an extensive plan of such a crisis vehicle cautioning framework that utilizes between vehicle correspondences, yet in addition envelops roadside foundation like traffic lights. Andréa's additionally proposed, different vehicles are not just cautioned of a moving toward crisis vehicle; they likewise get itemized course data. In light of this data, opportune and suitable response of different drivers is conceivable.

Jae et.al [26] have displayed, a street reservation plot that gives quick and safe reaction to crisis vehicles utilizing omnipresent sensor organize. What's more is to enable crisis vehicles to save a street on a turnpike for landing to the location of the mishap rapidly and securely. Additionally assess the presentation by three reservation strategies (No, Hop, and Full) to demonstrate that crisis vehicles, for example, ambulances, fire engines, and squad cars can quickly and securely arrive at their goal and this work exhibitions demonstrates that the normal speed of street reservation is about 1.09 ~ 1.20 occasions quicker than that of non reservation at different stream rates. Be that as it may, street reservation ought to think about the speed of the crisis vehicle and the street thickness of the crisis vehicle handling bearing, because of Hop Reservation and Full Reservation execution examination investigation and which can ensure security driving of crisis vehicles without diminishing their speed and help to moderate traffic clog.

Yuichiro et.al [27] have proposed, specially appointed system, multi-bounce correspondence is utilized and source hub builds courses to goal. Utilizations of specially appointed system are entomb vehicle correspondence and sensor organize, etc. Among them, remote sensor system is appealing in a crisis, for example, fiascos. In this application, one of the issues is clog for expanding of traffic of the pressing and medicinal information bundles on remote correspondence courses. It is an issue to be illuminated to ensure nature of administration in specially appointed system in a crisis. Here utilizing convention to improve transmission delay for specially appointed system in a crisis. The principle courses (the briefest courses) are built by utilizing a proactive directing convention, OLSR (Optimized Link State Routing), due to this reason, the system topology is no change and substantial traffic. Furthermore, the elective courses are built by utilizing a receptive steering convention, AODV (Ad hoc On-request Distance Vector), when a hub get a control bundle of blockage recognize from clog hub. In this manner, it is dodged to cover of principle courses and lessen deferral and bundle misfortune. Furthermore, information parcels are given need level and the low need bundle utilizes the elective course.

Soufiene et.al [28] have concentrated on the specific issue of traffic the board for crisis administrations, for which a deferral of couple of minutes may cause human lives hazards just as budgetary misfortunes. The objective is to lessen the idleness of crisis administrations for vehicles, for example, ambulances what's more, squad cars, with least pointless interruption to the normal traffic, and forestalling potential abuses.

To this end, Soufiene have propose to structure a system wherein the Traffic Management System (TMS) may adjust by powerfully altering traffic lights, changing related driving strategies, prescribing conduct change to drivers, and applying fundamental security controls. The decision of an adjustment relies upon the crisis seriousness level reported by the crisis vehicle(s). Maybe the seriousness level ought to be confirmed by relating specialists to protect safety efforts.

Ganesh et.al [29] have proposed, VANETs (Vehicular Ad Hoc Networks) target easing this issue improving vehicles' portability, expanding street security and furthermore looking to have progressively manageable urban areas. Toward the start of the advancement of vehicular innovations, the principle objective was to have progressively productive and more secure streets. These days, on account of the enormous advancement in remote advances and their application in vehicles, it's conceivable to utilize Intelligent Transportation System (ITS) that will change our approach to drive, improve street security, and help crisis administrations. A review of arranged Intelligent Traffic Systems (ITS) concerning our proposed plan is depicted in this paper. It presents another framework comprise of a shrewd city structure which has Intelligent Traffic Lights (ITLs) arranged at each convergence that transmit data about traffic conditions and give the driver blockage free briefest way in crisis that takes appropriate outing choices.

Dheeraj et.al [30] have displayed, as number of vehicles on the streets is expanding continually, this framework is neglecting to serve traffic clog issues particularly on the convergences. Because of traffic blockage High Priority Vehicles (HPV) likewise stall out in rush hour gridlock which results delay in their administrations. HPV like ambulances, fire unit and so forth needs to serve different causalities. It is significant for HPV to reach on schedule. There is a need of framework that expects to give way to HPV to reach as fast as would be prudent. Which gives need based methodology. It targets constructing a client intuitive framework for HPV in which a HPV driver can send solicitation to the framework to which the framework reacts intelligently. Need of Road Segments (RS) at a crossing point is determined and traffic light turns green for the RS with most noteworthy need.

Pothirasan et.al [31] have introduced, an effective method to guarantee smooth driving without mishap and a simpler method to distinguish the driver utilizing vehicle to vehicle and vehicle to framework to such an extent that a computerized and concentrated framework to control traffic framework can be made conceivable. Correspondence framework is proposed. With such vehicular correspondence framework, a directed and trained approach to vehicle is conceivable and furthermore avoids infringement of principles to a most extreme degree. Future work incorporates combination of web of things to be utilized with the vehicle to vehicle and vehicle to foundation. The capacity of imparting and organizing between vehicles can set the needs among the vehicles included additionally pothirasan have proposed "Canny Transportation System"(ITS) to deal with the traffic stream which is demonstrated as to close by to "Stop and Move" and to improve the effectiveness of traffic stream which thus lessens the mishaps.

Marsha et.al [32] have created framework for ongoing traffic observing utilizing Internet of Things (IoT) stage and detecting innovation. In this framework, Ultrasonic sensors are utilized to distinguish vehicle traffic levels at the paths; this information is gotten at the controller and transmitted to web server through a Wi-Fi module. The observed information is put away and investigated in the server. Here traffic is constrained by traffic sign control technique which relies upon the distinguishing traffic levels at the paths. In the event that any path gives a high traffic level, at that point it gives most elevated need to passing vehicles. RF handsets used to convey the fundamental framework to need framework which gets and transmits traffic related message. This framework is given at the convergence of paths which is solid, straightforward and minimal effort.

M.E.Harikumar et.al [33] have proposed framework is for crisis vehicles, which are in path recorded with traffic. By utilizing ZigBee, a convention is produced for vehicle-to-vehicle correspondence to advise the nearness regarding the Ambulance (or other crisis vehicles) to vehicles in path lastly to traffic lamppost. This framework will give answer for the issue of rescue vehicle clearing the path because of traffic at basic circumstance. The fundamental issue in the present situation is expanding traffic blockage because of numerous reasons and consistently it is basic to deal with during most crisis conditions. In this manner, the characterizing correspondence convention between vehicles to interface with traffic control unit so the emergency vehicle entering paths gets cleared.

III. PROBLEM METHODOLOGY AND SYSTEM MODEL

This part expresses an optimal intelligent vehicle control system for emergency vehicle using visible light communication network (OVIC). By pursuing this, we were described about Improved Whale Optimization (IWO), Differential Search Algorithm, Dragonfly Algorithm.

A. Problem Methodology

Begum et.al [34] have presented, Traffic and road accidents are one of the most crucial problems the world is facing now days. Over speeding, negligence while driving and high congestion on the road results in loss of precious human lives.

Emergency vehicles are responsible to respond and reach at accident sight. The main problem for this methodology is to find the best preemption technique and develop an algorithm that can minimize traveling time for Emergency vehicles and provide information to select shortest path to avoid traffic. Traffic safety information broadcast from traffic lights using VLC is a new cost effective technology which can draw attention to drivers to take necessary safety measures. An optimal visible light communication (OVLC) network that allows vehicles which have provides collision aware data transmission to improve the chance of transmitting information successively according to the network condition.

From [21]-[35], focused on optimal intelligent vehicle control system for emergency vehicle using with and without light communication networks. There are several approaches are using different technologies. Which are only focuses on reducing the traffic congestion techniques. In [35] framework only focus on collision detection and data transmission using of light communication networks and data transmission based on network condition. This work is implemented only for vehicle collision and data transmission, suppose, emergency vehicles interrupt on traffic congestion, this methodology detects and minimizes the collision with certain time, emergency vehicles wait until this system finds the collision, It leads waste of time of emergency vehicle. To overcome these problems,

1) We propose an optimal intelligent vehicle control (OIVC-VLC-VANET) system for emergency vehicle by intelligent traffic clearance. In OIVC, we first propose improved whale optimization (IWO) algorithm for grouping the vehicle nodes based on their behaviors.
2) Second, differential search algorithm is used to select next forwarding node using multiple constraints received from vehicles.
3) Third, the dragonfly algorithm is proposed for avoiding extra time due to the control packets exchange process. The results of proposed OIVC system can perform very efficient in terms of quality constraints than existing systems.

B. *System Model*

The proposed Optimal Intelligent Vehicle Control System for emergency vehicle by intelligent traffic clearance (OIVC-VLC-VANET) scheme is shown in figure 1. Initially, we differentiate and grouping the vehicle nodes based on their behaviors; like which one is emergency vehicle or not using intra clustering routing, which is group particular vehicle nodes, these process are done by using of improved whale optimization (IWO). Then we select the next forwarding node (cluster head and collision vehicles) using of inter cluster routing also multiple constraints are energy consumption and packet loss, throughput, delay, fairness index received from vehicles using of differential search algorithm. During the signal forwarding or control packets exchange process, we using the dragonfly algorithm for avoiding extra time.

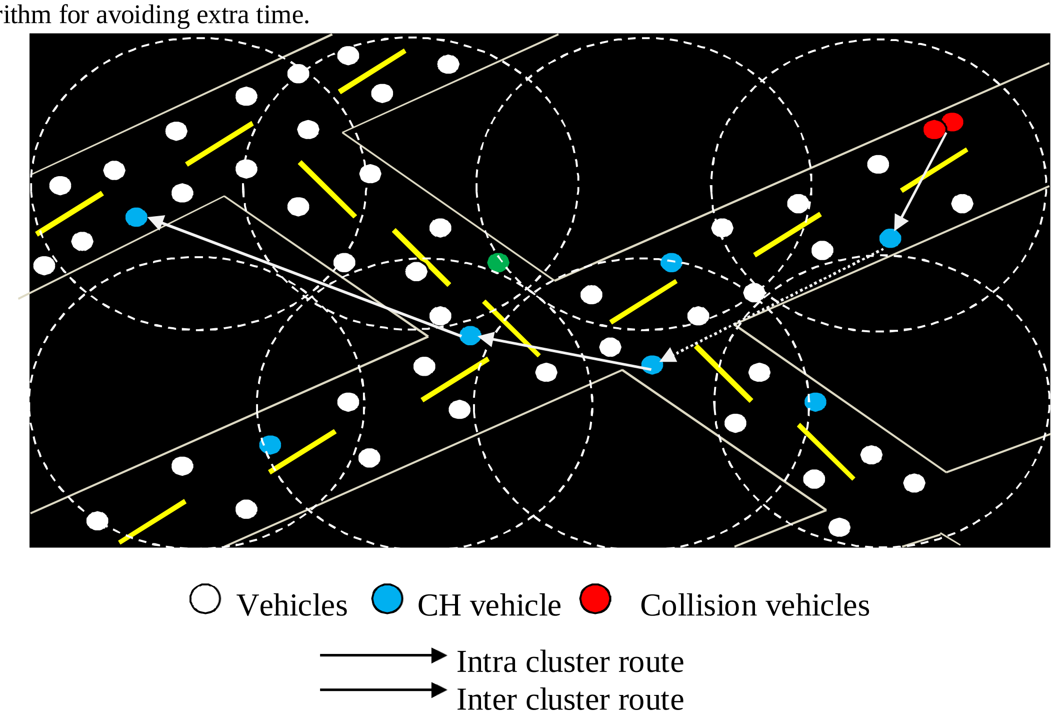

Figure 1. Proposed OIVC scheme

IV. OPTIMAL INTELLIGENT VEHICLE CONTROL SYSTEM FOR EMERGENCY VEHICLE USING VISIBLE LIGHT COMMUNICATION NETWORK (OIVC-VLC-VANET)

A. *Grouping the vehicles using an Improved Whale Optimization*

A whale optimization algorithm is newly developed and metaheuristic algorithm. It is a one of the biological inspired algorithm, this IWOA is works based on whale hunting technique. Which has following three stage hunting technique, they are encircling prey, bubble-net attacking, Exploration-searching for prey. Here we using these techniques for grouping the vehicles based on their behaviors.

1) *Encircling prey (Exploration Phase I)*

In this criteria, the whale search the prey (little fish) also identify the prey location and encircling them More over, the best prey or best target is identified by the best agent of whale. The search agent (whale) also updates the positions randomly. This behavior of whale is represented by following equation (1),

$$\vec{W} = \left| V . \vec{X^*}(t) - \vec{X}_p \right| \tag{1}$$

Here, iteration counter is represented t and best agent position is denoted $X^*(t)$, agent current vector position is represented as $\vec{X}_p(t)$. Further we write,

$$(\vec{X}_p + 1) = \vec{U} . \vec{W} \tag{2}$$

$$\vec{U} = 2\vec{u} . \vec{r} - \vec{u} \tag{3}$$

$$\vec{V} = 2\vec{r} \tag{4}$$

Here, random numbers is represented $\vec{r} \in [0,1]$ three vectors $\vec{U}, \vec{r}, \vec{u}$ are used for provides best one. If $\vec{u}$ minimize from 2 to 0, which is provides better exploration and decides that agent is best or not. Suppose the $\vec{U}$ value is >1, the random search agent is used, if $\vec{U}$ have <1, updating the current best solution.

2) *Bubble-net attacking (Exploration Phase II)*

In these criteria, represents phase II, the whale hunting and captures the prey through the different types of producing the bubbles. There are two types of techniques are available, they are, shrinking encircling mechanism and Spiral updating position.

a) *Shrinking encircling mechanism*

The shrinking encircling mechanism is employed the minimize the values of $\vec{u}$ from 2 to 0 using the equation (3) and the value of $\vec{U}$ depends on $[-u, u]$.

b) *Spiral updating position*

In this criteria, finding the distance between whale and prey and creates the spiral shape of bubbles on prey. It can be written as equation (5),

$$\vec{X}_p(t+1) = \vec{W} . e^{bl} . \cos(2\pi l) + \vec{X}^*(t) \tag{5}$$

Where, the distance $\vec{W} = \left| \vec{X^*}(t) - \vec{X}_p \right|$ between whale and prey represents and b is shape of spiral movement of whales, at random values over the interval [-1 ,1]. In addition, the probability among whale and prey according the behaviors is 50%, which is written as,

$$(\vec{X}_p + 1) = \begin{cases} X^*(\vec{t}) - \vec{W}.\vec{V} \\ D.e^{bl}.\cos(2\pi l) + \vec{X}(t)^* \end{cases} \quad (6)$$

3) Searching for prey (Exploration Phase III)

Phase III, the whale again search the prey randomly. Here , the whales are conduct the exploration (global search) and value greater or equal to 1, then whales automatically update to best whale fitness function and make the global search, the new position of whale is calculated by following equations (7),(8),

$$\vec{W} = \left| V.\vec{X}^*_{ran}(t) - \vec{X}_p \right| \quad (7)$$

$$\vec{X}_p(t+1) = \vec{X}_{ran} - \vec{U}.\vec{W} \quad (8)$$

The random value describes position of available whales represented $\vec{X}_{ran}$. The algorithm and flowchart of improved whale optimization algorithm is following, from figure .2, the flow chart explains how to grouping the vehicles based on behavior using Improved Whale Optimization Algorithm.

Algorithm 1	Improved Whale Optimization
Step 1	Initialize the population X_{ini} = (1,2,….,n)
Step 2	Computes the fitness search agent
Step 3	Best search agent= X^*
Step 4	while (number of iterations in max>t)
Step 5	for every search agent Update U,t,r,u
Step 6	if 1 (r<0.5)
Step 7	if 2 ($\lvert U \rvert < 1$) Update the current search agent position
Step 8	else if 2 ($\lvert U \rvert \geq 1$) Select the random search agent X_{ran} Update the current search agent position end if 2
Step 9	else if 1(r$\geq$0.5) Update the current search position end if 1 end for
Step 10	Check the search agent and search space Calculate the fitness function of every search agent Update the X^* if there best solution t=t+1 end while return X^*

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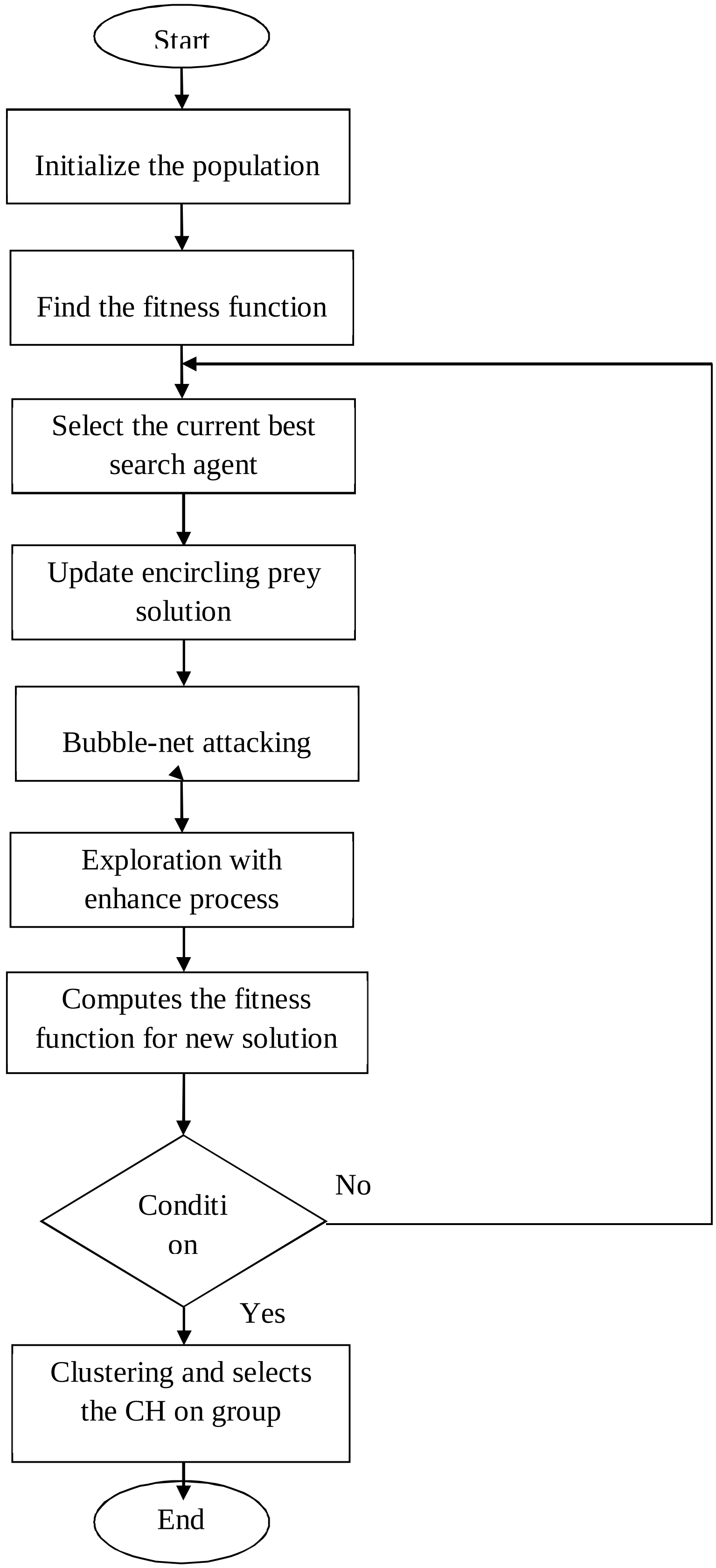

Figure 2. Process of IWOA using grouping

B. Node selection using Differential Search Algorithm

Differential search algorithm (DSA) is a novel population-based met heuristic optimization algorithm developed for solution of highly nonlinear, multivariable, and multimodal optimization problems.DSA simulates the used by an organism to migrate. The main motivation of DSA is the migration behavior of living beings, which move away from a habitat having low capacity of food resources. The migration process entails movement of large number of individuals comprising a super organism. A super organism moves towards habitat having more food capacity. Once it finds new fruitful habitat named as stopover site, it settles in the new habitat for the time being and continues its migration towards more fruitful habitats. DSA starts by generating individuals of respective optimization problem corresponding to an artificial-super organism. Hereafter artificial-super organism tries to migrate from its current position to the global minimum value.

In DSA, $X_{ini} = 1,2,.....,N$ denoted more members in dimension of the problem, for example, $X_{ij} = 1,2,....,D$ represents numbers of size and individuals. The process of DSA is described in following steps,

1) Step 1: Initialize the every artificial organism

We initialize the every individuals or artificial organisms of members to a random position. This is represented following equation (9),

$$X_{ij} = ran \times upp_n - low_n + low_n \tag{9}$$

Here, upp_n, low_n are upper and lower bounds of n^{th} dimension of corresponding problems.

2) Step 2: Initialize the control parameters

The individual perturbation member position calculated frequency is value is represented in F_1 and F_2. We can determine the amount of perturbation size of member position in every individuals by the help of scale. It will produces the gamma random number generator.

$$F_1 = 0.3 \times ran_1 \tag{10}$$

$$F_2 = 0.3 \times ran_2 \tag{11}$$

$$Scale = ran_g [2 \times ran_3] \times ran_4 - ran_5 \tag{12}$$

Here, the gamma generator is represents ran_g and $ran_1, ran_4, ran_5, ran_3, ran_4$ are random number generators.

3) Step 3: Calculate the stopover site

The Brownian-like, random-walk model are used for find the stopover sites during migration work. We can move towards to the targets and randomly chooses the individuals for explores the stopover sites, it is described as donar. The stop over site is randomly calculated individuals, which is represented as,

$$Stopover\ site = Superorganism + Scale \times donor - Superorganism \tag{13}$$

$$donor = [X_{rav} - Superorganism] \tag{14}$$

4) Step 4: Calculate the participating members

The member of participating in search process is described by the stochastic scheme, the values of F_1 and F_2 are described in equation (10),(11) used in stochastic scheme.

5) Step 5: Check the boundary limits of stopover site

Which is satisfying following condition, During migration process occurring, the biological individual of some dimensions,

$$Stopover\ site_{ij} > X_{ij} \tag{15}$$

The above equation (15) carry outs the following equation (16),

$$Stopover\ site_{ij} = R(X_{ij} - low_n) + low_n \tag{16}$$

Here, R is uniform random number.

6) Step 6: Choosing the superior location

Each individual having each generation evaluation of search process of DSA and $Stop\,over\,site_{ij}$ comparing with fitness value of current location to determine the new location. The determined location is more superior than the $Stop\,over\,site_{ij}$,then we can replace the current position individual.

7) Step 7: Check the termination criterion

If the stopover site condition is more associate the individual of artificial organisms, then the corresponding individual moves to stopover site, These all process are continues until the optimization result is satisfied, otherwise the step 2 and 6 repeated until the value of global minimum is reached.

C. Time Management Of Control Packets Exchange Process Using Dragonfly Algorithm

The dragonfly algorithm is one of the met heuristic algorithm based swarm intelligence, which is inspired by the dragonfly's behaviors. There are two phases available, one is exploration and another one is exploitation, these behaviors are whether static or dynamically searching food or avoiding the enemy. The behavior of this algorithm is have three stages, separation, alignment and cohesion, which is represented following equations,

1) Initialization

- *Separation*

To avoid the collision with neighbor, the separation process is occurred, this is represented by,

$$S = -\sum_{j=1}^{N} P - P_j \tag{17}$$

Here, the current individual position is represents P also j-th neighboring individual of position shown P_{ij} . The individual neighboring numbers are represented N.

- *Alignment*

The speed of agents (dragonfly) is matched with neighboring individuals is represented following equation,

$$A = \frac{\sum_{j=1}^{N} V_e}{N} \tag{18}$$

Where, the velocity of j-th neighboring individual is represents V_e

- *Cohesion*

The tendency of individuals towards the center of herd is represents the cohesion.
Which is represents the following equation,

$$C = \frac{\sum_{j=1}^{N} P_j}{N} - P \tag{19}$$

2) Updating the position of vectors

In addition, there are two behaviors of dragonfly based on their food searching behavior, it can be written as, and the attraction with regards to food source can be represented as,

$$F = P^{+} - P \tag{20}$$

Where, position of food source is P^{+}

The distraction regards to the enemy is represented by the following equation,

$$E = P^{-} - P \tag{21}$$

The updating position is essential one, the movements and step, position of dragonfly is considered here. First we finds step vector,

$$\Delta P_{t+1} = \left(s_i S + a_i A + c_i C + f_i F + e_i E\right) + w \Delta P_t \tag{22}$$

where S shows the separation weight, A is the alignment weight, c indicates the cohesion weight,F is the food factor, F_i is the food source of the i-th individual, E is the enemy factor, E_i is the position of enemy of the i-th individual, w is the inertia weight, and t is the iteration counter S_i indicates the separation of the i-th individual, a_i is the alignment of i-th individual C_i cohesion of the i-th individual

After computing step vector, we finding the position vector,

$$P_{t+1} = P_t + \Delta P_{t+1} \tag{23}$$

The pseudo-code description of dragonfly algorithm is following,

Pseudo-code for dragonfly algorithm

Initialize the dragonflies population P_i (i=1,2,….,n)

Set the step vectors ΔP_i $(i = 1,2,...,n)$

while the end condition is not satisfied

  Compute the objective values of all dragonflies

  Update the enemy and food source

  Update S,A,F,C,w and E

  Compute S,A,F,C,w and E

  Update the radius of neighboring

if each dragonfly have minimum one neighbor dragonfly

  Update velocity vector

  Update position vector

else

  Update position vector

else

Check also correct the new position depends on boundaries of variables

end while

V. RESULT AND DISCUSSION

The proposed Optimal Intelligent Vehicle Control System for emergency vehicle by intelligent traffic clearance (OIVC-VLC-VANET) scheme is simulated using network simulator (NS2) tool . Here, we have considered the simulation area 500m x 500m, with bidirectional road scenario. The number of vehicles is given to this work is 20, 40,60,80,100 and we set the speed of vehicles is 20, 40, 60, 80, 100 in Kmph. Here, improved whale optimization (IWO) algorithm is grouping the vehicle nodes based on their behaviors. we choose the next forwarding node using multiple constraints received from vehicles by using of the differential search algorithm . During forwarding the nodes, we using the dragonfly algorithm for avoiding the packet loss. The performance of proposed OIVC network is tested using of NS2 tool with two different test scenarios are performance of analysis of throughput and speed of vehicles. The simulation parameters and test scenarios are described in Table 1 and 2 respectively

Table 1 Simulation parameters

Parameter	Value
Network area	1250m X 1250m
Number of vehicles	20,40,60,80,100 (variable)
Average speed of vehicles	36kmph
Maximum speed of vehicles	50kmph
Packet size	1400 bytes
Simulation time	500 s
Traffic source	Constant bit rate (CBR)
MAC protocol	IEEE 802.15.7

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Table 2 Test scenarios		
Scenarios	Number of vehicles	Speed of vehicles (kmph)
1	20, 40,60,80,100	40
2	40	20, 40, 60, 80, 100

A. Performance Analysis

During this process, the constraints of sensor nodes parameters throughput, delay and packet loss and energy consumption, fairness index performances are analysis the following graphs,

1) Throughput (mbps)

In this test part, the number of vehicles is 20, 40, 80, 100, using our proposed OIVC, for throughput, It is increases slightly 60% than existing scheme OVLC. From the below figure. 3, clearly explain throughput is increases than existing method. From this analysis, the throughput is increases and improved by proposed OIVC.

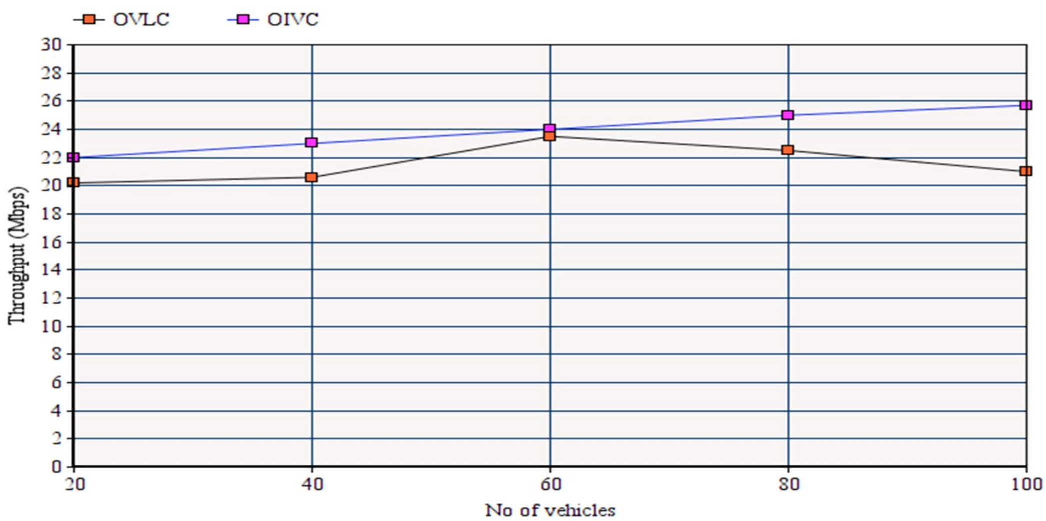


Figure 3. Number of vehicles vs throughput

2) Delay(S)

In this analysis, The number of vehicles are represented 20, 40, 60, 80, 100 and corresponding delay values of our proposed is 0.3, 0.4, 0.6, 0.7, 0.8 . From the figure. 4, the proposed and existing values are shows there. The proposed OIVC delay is decreases 30% decreases than existing OVLC system.

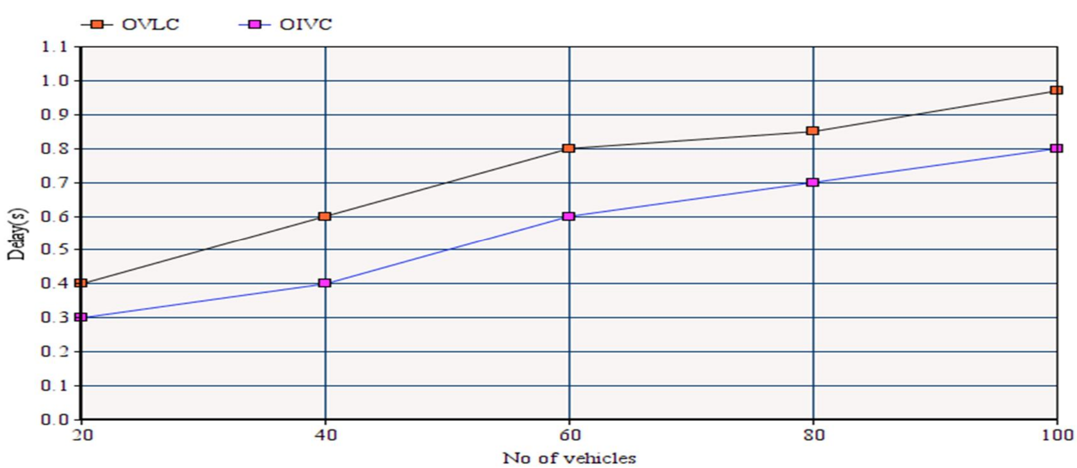


Figure 4. Number of vehicles vs Delay(s)

3) Packet loss

In this test scenario, the packet loss is decreased 29% lower than existing scheme OVLC. The fig.5 is clearly explains the packet loss is slightly decreases.

4) Energy Consumption (J)

The energy consumption comparison of proposed OIVC and existing OVLC scheme is given in Fig.6, which is showns the energy consumption of proposed OIVC scheme is very low in terms of 45% lower than existing OVLC scheme.

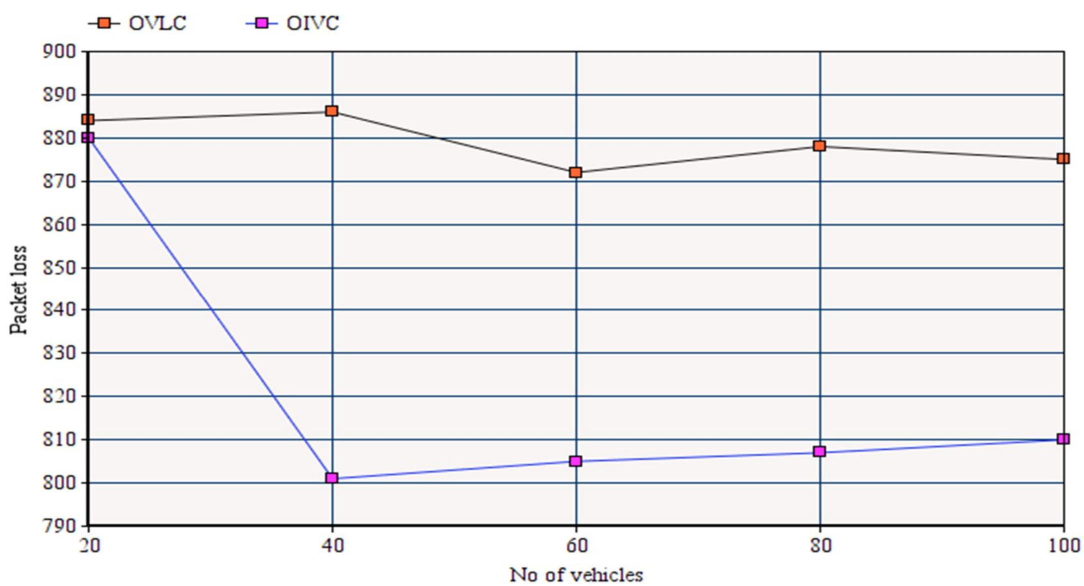


Figure 5.Number of vehicles vs Packet loss

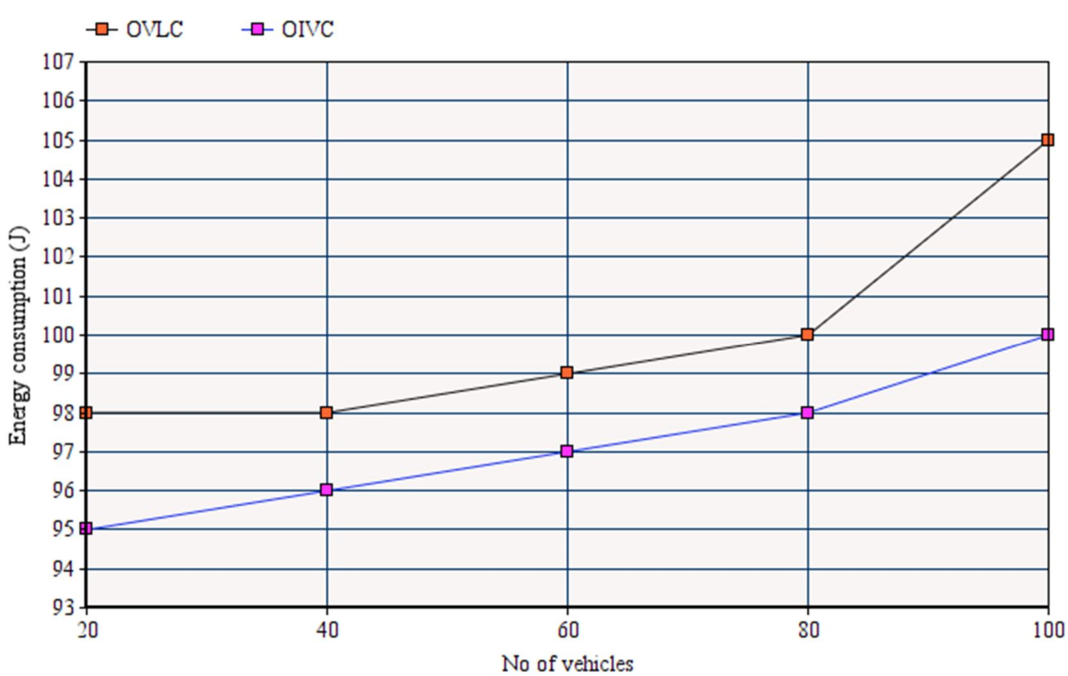


Figure 6.Number of vehicles vs Energy consumption

5) Fairness Index

Fairness index of proposed OIVC performance analysis is shown in fig.7. Which is clearly explains the fairness index is slightly increase 50% than the existing OVLC. Comparing with the existing method, the fairness index is increased and improved.

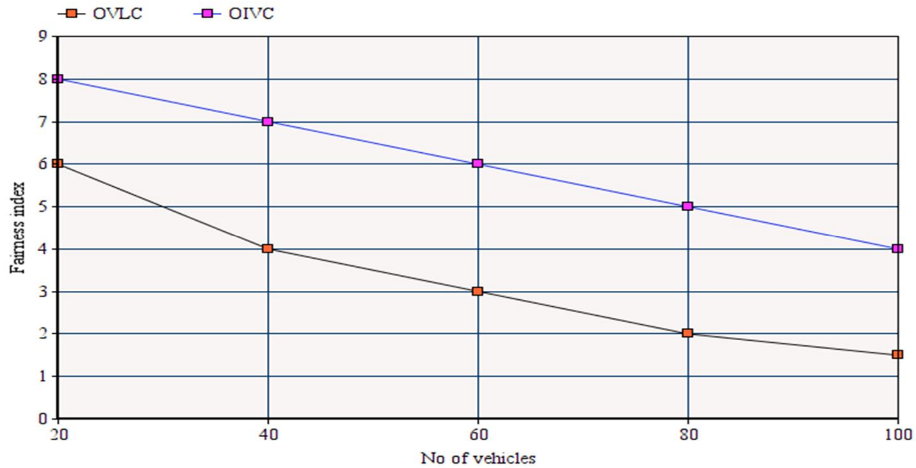


Figure 7.Number of vehicles vs Fairness index

B. Performance analysis (vehicle speed)

1) Throughput (mbps)

The figure. 8 show the throughput analysis of vehicle speed. The proposed and existing through put is given in graph, our proposed OIVC scheme is increased 65% than the existing scheme OVLC.

2) Delay (S)

From fig. 9 the delay is minimized 40% by using of proposed OIVC. Comparing with existing method OVLC, the delay is decreased rapidly.

3) Packet Loss

The analysis of packet loss rate with vehicle speed performance using proposed OIVC scheme is shown in fig.10 , is clearly shows the packet loss is decreases. Comparing with existing scheme, the packet loss rate is 30% decreased.

4) Energy Consumption (J)

From fig. 11 the energy consumption is minimized 47% by using of proposed OIVC. Comparing with existing method OVLC, the energy is decreased rapidly**.**

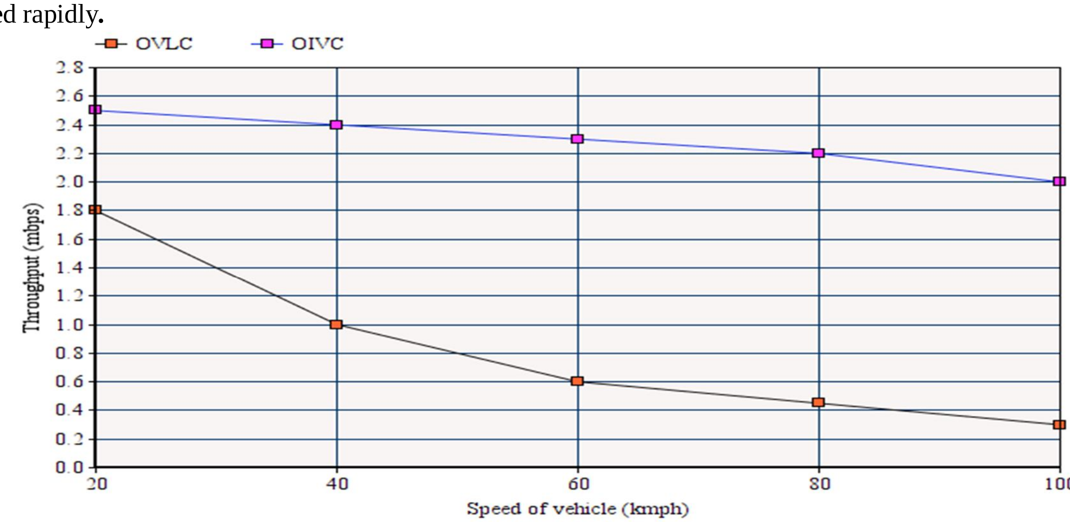


Figure 8. Speed of vehicle vs Throughput (mbps)

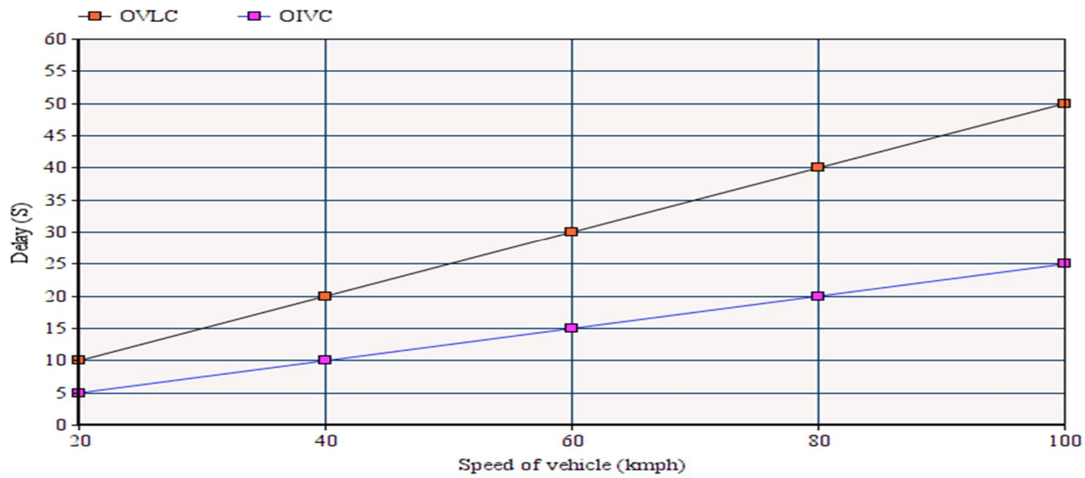


Figure 9. Speed of vehicle vs Delay(S)

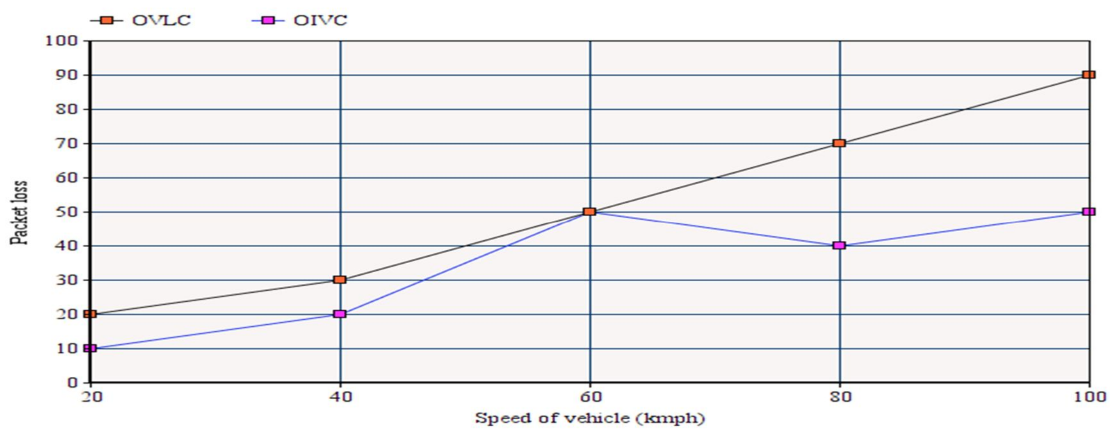


Figure 10. Speed of vehicle vs. packet loss

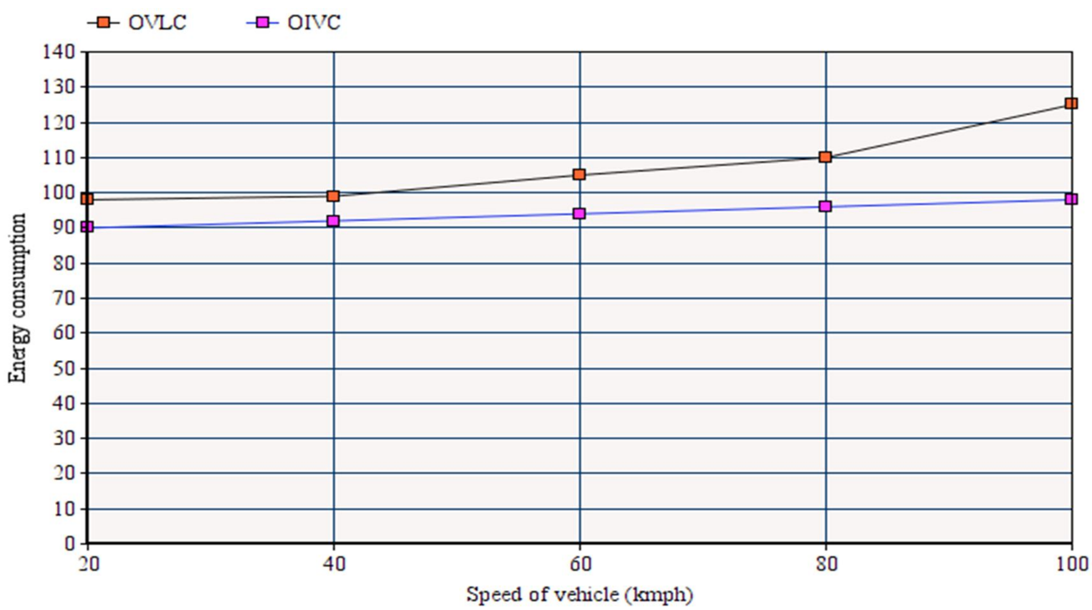


Figure 11. Speed of vehicle Vs Energy consumption

5) Fairness Index

Fairness index of proposed OIVC performance analysis is shown in fig.12. Which is clearly explains the fairness index is slightly increase 40% than the existing OVLC. Comparing with the existing method, the fairness index is increased and improved.

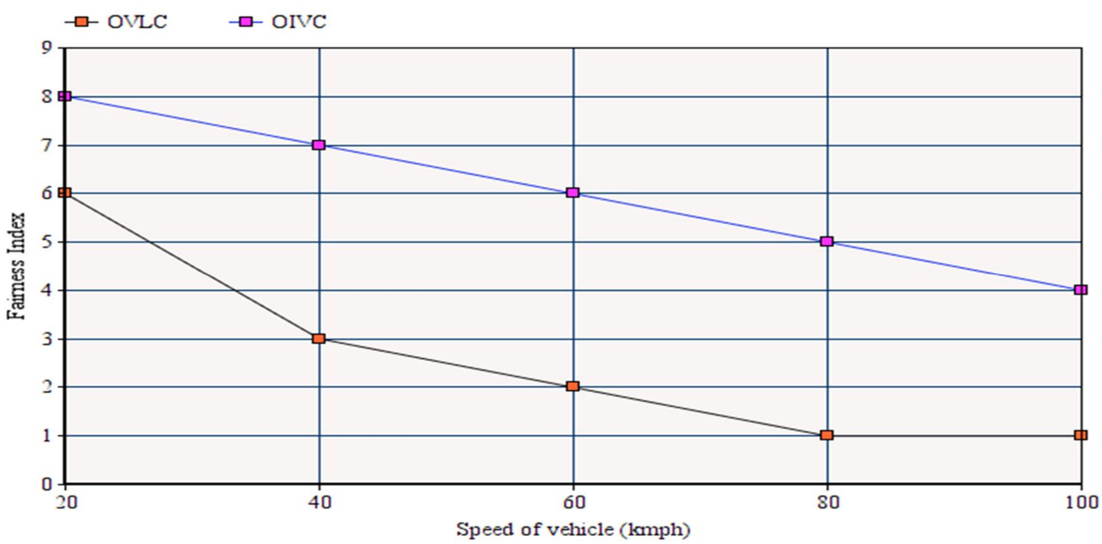


Figure 12. Speed of vehicle Vs Fairness Index

VI. CONCLUSION

We proposed an Optimal Intelligent Vehicle Control System for emergency vehicle by intelligent traffic clearance (OIVC-VLC-VANET) system. The grouping process of vehicles depends upon their behaviors done by using of proposed Improved Whale Optimization (IWO). By the help of Differential Search Algorithm, we choose the further forwarding nodes using multiple constraints such as energy consumption, delivery rate, and pocket loss rate etc. Also we avoided the vast of time during control packets exchange process, by using of proposed Dragonfly Algorithm. The result of proposed OIVC-VLC-VANET establishes and the proposed OIVC-VLC-VANET gives high efficiency in terms of quality constraints. In addition, comparing with existing state art of methods, the performance and result, analysis out of this proposed method is high efficient.

REFERENCES

[1] Căilean, A.M. and Dimian, M., 2017. Current challenges for visible light communications usage in vehicle applications: A survey. IEEE Communications Surveys & Tutorials, 19(4), pp.2681-2703.
[2] Dang, Q.H. and Yoo, M., 2017. Handover procedure and algorithm in vehicle to infrastructure visible light communication. IEEE Access, 5, pp.26466-26475
[3] Tram, V.T.B. and Yoo, M., 2018. Vehicle-to-vehicle distance estimation using a low-resolution camera based on visible light communications. IEEE Access, 6, pp.4521-4527
[4] Yang, Z., Wang, Z., Zhang, J., Huang, C. and Zhang, Q., 2015, May. Wearables can afford: Light-weight indoor positioning with visible light. In Proceedings of the 13th Annual International Conference on Mobile Systems, Applications, and Services (pp. 317-330). ACM.
[5] Bazzi, A., Masini, B.M., Zanella, A. and Calisti, A., 2016. Visible light communications as a complementary technology for the internet of vehicles. Computer Communications, 93, pp.39-51.
[6] Guido, G., Gallelli, V., Rogano, D. and Vitale, A., 2016. Evaluating the accuracy of vehicle tracking data obtained from Unmanned Aerial Vehicles. International journal of transportation science and technology, 5(3), pp.136-151
[7] Premachandra, C., Yendo, T., Tehrani, M.P., Yamazato, T., Okada, H., Fujii, T. and Tanimoto, M., 2015. Outdoor road-to-vehicle visible light communication using on-vehicle high-speed camera. International journal of intelligent transportation systems research, 13(1), pp.28-36.
[8] Yoo, J.H., Jang, J.S., Kwon, J.K., Kim, H.C., Song, D.W. and Jung, S.Y., 2016. Demonstration of vehicular visible light communication based on LED headlamp. International journal of automotive technology, 17(2), pp.347-352.
[9] Do, T.H. and Yoo, M., 2019. Visible Light Communication-Based Vehicle-to-Vehicle Tracking Using CMOS Camera. IEEE Access, 7, pp.7218-7227.
[10] Yang, Y., Chen, M., Guo, C., Feng, C. and Saad, W., 2019. Power Efficient Visible Light Communication (VLC) with Unmanned Aerial Vehicles (UAVs). IEEE Communications Letters.
[11] Ala'F, K., AlFasfous, N., Theodory, R., Giha, S. and Darabkh, K.A., 2018. An experimental evaluation and prototyping for visible light communication. Computers & Electrical Engineering, 72, pp.248-265.
[12] Xiong, J., Huang, Z., Zhuang, K. and Ji, Y., 2016. A cooperative positioning with Kalman filters and handover mechanism for indoor microcellular visible light communication network. Optical Review, 23(4), pp.683-688.

[13] Singh, A., Gupta, R. and Rastogi, R., 2015, March. A Novel Approach for vehicle tracking system for Traffic Jam Problem. In 2015 2nd International Conference on Computing for Sustainable Global Development (INDIACom) (pp. 169-174). IEEE.

[14] Baouche, F., Trigui, R., Billot, R. and El Faouzi, N.E., 2014, November. Electric vehicle shortest path problem with replenishment constraint. In 2014 International Conference on Connected Vehicles and Expo (ICCVE) (pp. 514-515). IEEE.

[15] Sharma, S., Pithora, A., Gupta, G., Goel, M. and Sinha, M., 2013. Traffic light priority control for emergency vehicle using RFID. Int. J. Innov. Eng. Technol, 2(2), pp.363-366.

[16] Al-Ostath, N., Selityn, F., Al-Roudhan, Z. and El-Abd, M., 2015, July. Implementation of an emergency vehicle to traffic lights communication system. In 2015 7th International Conference on New Technologies, Mobility and Security (NTMS) (pp. 1-5). IEEE.

[17] Petrescu, S. and Bucur, L., 2010. Real time traffic monitoring based on travel time minimization. IFAC Proceedings Volumes, 43(8), pp.267-272.

[18] Unibaso, G., Del Ser, J., Gil-Lopez, S. and Molinete, B., 2010, September. A novel CAM-based traffic light preemption algorithm for efficient guidance of emergency vehicles. In 13th International IEEE Conference on Intelligent Transportation Systems (pp. 74-79). IEEE.

[19] Sawade, O., Schäufele, B. and Radusch, I., 2016, February. Collaboration over IEEE 802.11 p to enable an intelligent traffic light function for emergency vehicles. In 2016 International Conference on Computing, Networking and Communications (ICNC) (pp. 1-5). IEEE.

[20] Shanmughasundaram, R., Vadanan, S.P. and Dharmarajan, V., 2018, February. Li-Fi Based Automatic Traffic Signal Control for Emergency Vehicles. In 2018 Second International Conference on Advances in Electronics, Computers and Communications (ICAECC) (pp. 1-5). IEEE.

[21] Di Febbraro, A., Giglio, D. and Sacco, N., 2004. Urban traffic control structure based on hybrid Petri nets. IEEE Transactions on Intelligent Transportation Systems, 5(4), pp.224-237.

[22] Buchenscheit, A., Schaub, F., Kargl, F. and Weber, M., 2009, October. A VANET-based emergency vehicle warning system. In 2009 IEEE Vehicular Networking Conference (VNC) (pp. 1-8). IEEE.

[23] Yoo, J.B., Kim, J. and Park, C.Y., 2010, June. Road reservation for fast and safe emergency vehicle response using ubiquitous sensor network. In 2010 IEEE International Conference on Sensor Networks, Ubiquitous, and Trustworthy Computing (pp. 353-358). IEEE.

[24] Koga, Y., Sugimoto, C. and Kohno, R., 2012, November. Congestion control routing protocol using priority Control for ad-hoc networks in an emergency. In 2012 12th International Conference on ITS Telecommunications (pp. 45-49). IEEE.

[25] Djahel, S., Salehie, M., Tal, I. and Jamshidi, P., 2013, March. Adaptive traffic management for secure and efficient emergency services in smart cities. In 2013 IEEE International Conference on Pervasive Computing and Communications Workshops (PERCOM Workshops) (pp. 340-343). IEEE.

[26] Khekare, G.S., 2014, February. Design of emergency system for intelligent traffic system using VANET. In International Conference on Information Communication and Embedded Systems (ICICES2014) (pp. 1-7). IEEE.

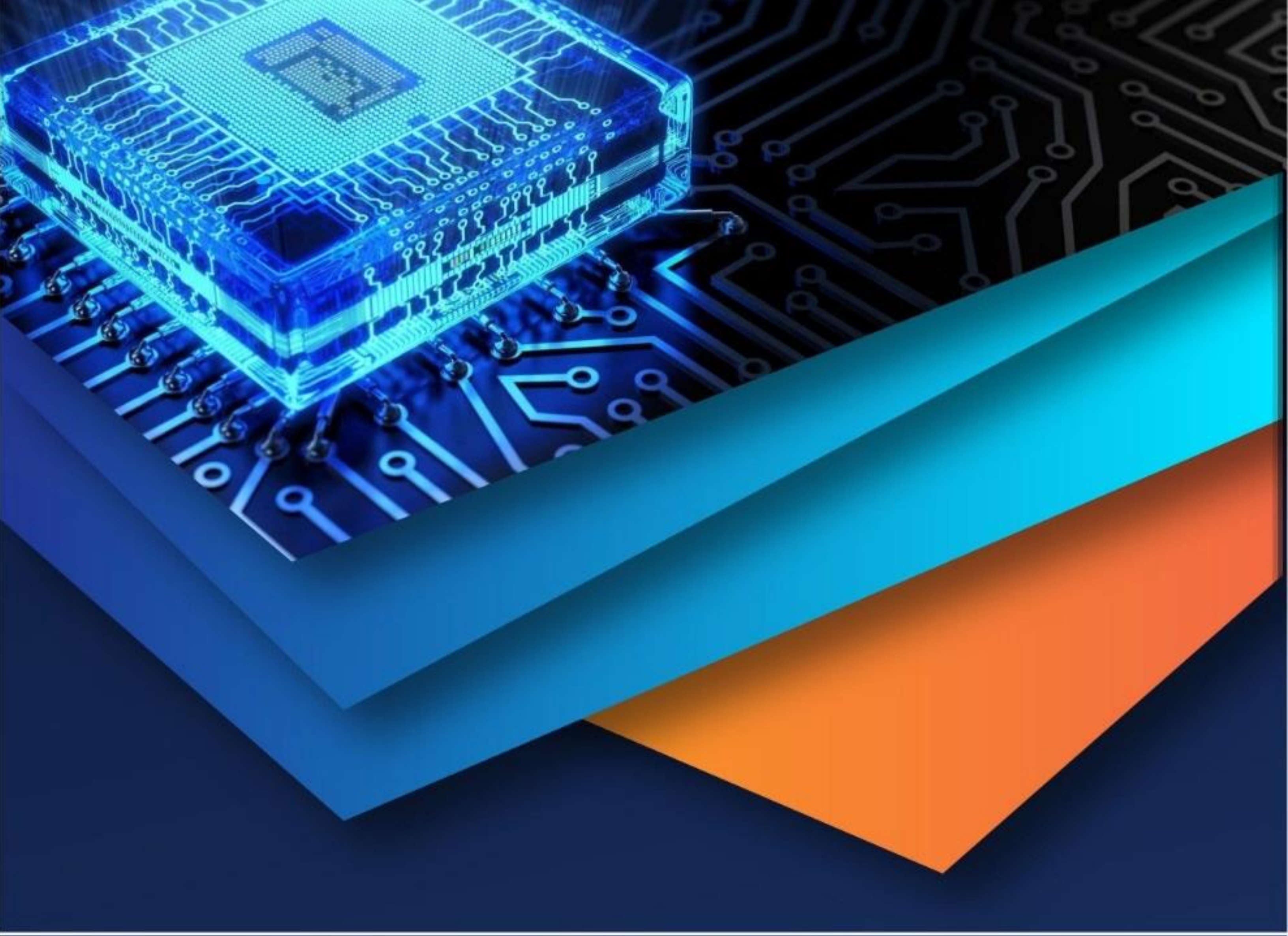
[27] Dang, D., Tanwar, J. and Masood, S., 2015, September. A smart traffic solution for High Priority Vehicles. In 2015 1st international conference on next generation computing technologies (NGCT) (pp. 466-470). IEEE.

[28] Pothirasan, N. and Rajasekaran, M.P., 2016, December. Automatic vehicle to vehicle communication and vehicle to infrastructure communication using NRF24L01 module. In 2016 International Conference on Control, Instrumentation, Communication and Computational Technologies (ICCICCT) (pp. 400-405). IEEE.

[29] Nagmode, V.S. and Rajbhoj, S.M., 2017, August. An IoT Platform for Vehicle Traffic Monitoring System and Controlling System Based on Priority. In 2017 International Conference on Computing, Communication, Control and Automation (ICCUBEA) (pp. 1-5). IEEE.

[30] Harikumar, M.E., Reguram, M. and Nayar, P., 2018, October. Low cost traffic control system for emergency vehicles using ZigBee. In 2018 3rd International Conference on Communication and Electronics Systems (ICCES) (pp. 308-311). IEEE.

[31] Begum, Shaeista & B. Patil, Nagaraj. (2019). An Intelligent Vehicle Control System for Enhancing Road Safety Using Optimal Visible Light Communication Network. Journal of Optical Communications. 10.1515/joc-2019-0049.



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