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Reducing Traffic in Smart Cities by using Shortest Path Algorithms

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***Abstract*—** Information is spread all through the city requiring little to no effort and ready to divert vehicles in development in the city to at long last accomplish shorter travel times and less congested driving conditions in smart communities. The Wi-Fi network is empowered for the driver terminals, because of that they can easily find the routes. This application proposes a constant framework for recommending appropriated customized courses in keen smart areas. The application need to collect the traffic data of past and the present data of the city. The driver hubs will get the briefest courses to the goal, if there is no immediate course to the goal then the calculation will get all the info roads which are specifically reachable from the present area to the goal. Shortest path algorithm like Warshall Floyd is used to find the optimal path to destination. The main aim of this approach is to increase the citizens' life.

***Keywords*—**Vehicular Ad-hoc Network (VANET), Mobile Ad-hoc Network (MANET, Ant Colony Optimization Algorithm (ACO), Particle Swarm Optimization (PSO), Artificial Bee Colony (ABC), Warshall Floyd

I. INTRODUCTION

VANET means Vehicular Ad-hoc Network. It is the subclass of mobile ad-hoc network (MANET). It is created based on the principles of MANETs. In VANET, vehicles are considered as mobile nodes and it creates an Ad-hoc network between the vehicles for the communication between the vehicles. Road safety is the major concern for the VANETs. The type of communication VANET uses is vehicle to vehicle (V2V), vehicle to infrastructure (V2I) and vehicle to roadside (V2R). The major use of VANET is to control traffic. There are many protocols are used to find the fastest route to the destination. It uses ad-hoc network. The vehicle is considered as node. The location of the vehicle is found by using the GPS service. In this paper, three soft computing algorithms are used and comparison between those algorithms is done to find the better algorithm to the destination. First one is Ant Colony Optimization (ACO) Algorithm. Second one is Particle Swarm Optimization (PSO) Algorithm. Third one is Artificial Bee Colony (ABC) Algorithm.

Ant Colony Optimization Algorithm (ACO) [4] figuring is a probabilistic framework for handling computational issues which can be diminished to finding extraordinary routes through outlines. The calculation has a place with Swarm insight techniques. The fundamental point of this calculation is to locate the ideal way in a diagram, in view of the conduct of ants.ACO performs model-based search. In ACO [2], ant moves in a random fashion in search of its food. On its return to its home, it starts to emit a substance called as pheromone. The other ant which found this emission of pheromone follows the same path to reach the destination. When more number of paths found this emission of pheromone follows the same path where there is a large amount of pheromone deposit. Over the time, the pheromone begins to vanish. The appealing quality gets decreased. The additional time it takes for an ant to go down the path and back again, the additional time the pheromones need to vanish. Pheromone stores are more on shorter routes than the more drawn out ones. Pheromone scattering also has the advantage of keeping up a vital separation from the joining to a locally perfect course of action. In case there were no vanishing by any extends of the creative ability, the routes picked by the essential ants would tend to be all the more appealing to the going with ones. Things being what they are, the examination of the plan space would be obliged. The general outcome is that when one ant finds a short route from the state to a sustenance source, ants will likely take after that way, and positive commitment to the long run prompts every one of the ants taking after a solitary way. The likelihood of the ant state settlement figuring is to duplicate this direct with "emulated ants" walking around the diagram addressing the issue to light up.

Particle Swarm Optimization (PSO) algorithm [11], is a solid stochastic progression technique in perspective of the improvement and understanding of swarms. It applies the possibility of social coordinated effort to basic considering. It uses different administrators (particles) that constitute a

swarm moving around in the yield space filtering for the best game-plan. Every molecule is overseen as a point in a N-dimensional space which modifies its "flying" as per its own specific flying establishment and besides the flying data of different particles. Every particle screens its headings over the span of activity space which are associated with the best arrangement that has completed so far by that particle. This regard is called particular best "pbest". Another best regard that is trailed by the PSO is the best regard obtained so far by any particle in the domain of that atom. This regard is called "gbest". The real considered PSO lies in restoring every particle toward its pbest and the gbest districts, with an optional weighted quickening at each time step.

Artificial Bee Colony (ABC) Algorithm is an advancement calculation in light of the canny conduct of the honey bee. It can be connected to take care of various types of issues. An arrangement of honey bees is called "swarm" which can effectively achieve errands through social participation. The utilized honey bees seek nourishment around the sustenance source in their memory and they share the data. The sustenance source that has higher quality will have an extensive opportunity to be chosen than the lower quality. The trading of data among honey bees is the most imperative event in the development of aggregate learning. The most essential piece of the hive regarding trading data is the moving zone. Correspondence among honey bees identified with the nature of sustenance sources happens in the moving zone. This move is known as a "Waggle move". Utilized foragers impart their data to a likelihood corresponding to gain the nourishment source, and use this data through waggle moving is longer in length. A passerby on the move floor, likely she can watch various moves and chooses to utilize herself and no more productive source. There is a more noteworthy likelihood of spectators picking more beneficial sources since more data is coursed about the more productive sources.

These soft computing algorithms are used to find the route to the destination. For optimal route, Warshall Floyd algorithm is used. Warshall Floyd is utilized for finding most brief ways in a weighted chart with positive or negative edge weights. The simulation is done in Network Simulator (NS2) [6]. The parameters like Network and Optimal Algorithm parameters are taken into consideration.

Rest of the paper is organized as follows, Section I contains the introduction of all the soft computing algorithms, Section II contain Literature Survey, Section III contain the problem definition of proposed algorithm, Section IV contain the proposed framework, Section V contain the applications, section VI explain the result and analysis, Section VII describes results and analysis, Section VII contain the conclusion.

II. LITERATURE SURVEY

This section reveals the kindred work carried out by the proposed model and the work done in measuring semantic association between web resources.

VANET means vehicular ad-hoc network [10]. Here the vehicles are considered as the mobile nodes and it creates an ad-hoc network between the vehicles. It also involves communication among the road side units. The main goal of VANET is to ensure road safety. The type of communication in VANET involves vehicle to vehicle (v2v), vehicle to infrastructure (v2i), vehicle to roadside (v2r) and in hybrid model v2v and v2i, v2v and v2r. The main use of the VANET is to control the traffic. There are many protocols in VANET [1] to find the fastest path to reach the destination. The network used in VANET is an ad-hoc network. There will be reliable message passing in VANET. There are two algorithms are used in VANET for clustering they are: ACO and PSO. These two algorithms are used to get better simulation results.

Dynamic Source Routing (DSR) [2] plot in light of the ACO Algorithm makes a high data packet movement extent in low end to end defer with low directing overhead and low imperativeness usage. In this arrangement, when a node needs to send a packet to another node, it first checks the reserve for existing routes. Right when no routes are known, the sender locally conveys the Route Request Control bundle (called the Req.Ant packet) to find the routes. This takes after the Ant Colony Optimization Algorithm; the Req.Ant packet incite through the framework and gather information of the course till it accomplishes the objective. At the objective, it sends Rep.Ant which contains course information of the contrasting Req.Ant with the source node through a comparable route. So the source node comes to know the route in perspective of the Rep.Ant parcel. The re-enactment comes to fruition demonstrate better appeared differently in relation to the present approach.

Red Swarm: Reducing travel times in smart cities using Bio-inspired algorithms manage diminishing the vehicle travel time [9]. Existing methodology utilized Red Swarm recommends a route to every vehicle by utilizing a few spots situated at traffic lights with a specific end goal to maintain a strategic distance from congested driving conditions by utilizing V2I interchanges. In the proposed approach, ideal course is found to the goal by utilizing the developmental calculations. The recreation comes about demonstrated better contrasted with the current approach.

Vehicular Ad-Hoc network (VANET) [5] is the combination of vehicles and road side units. The effective routing protocol [3] is needed to route data from source to destination. In this paper, performance parameters are computed using Zone Routing Protocol, Dynamic Source Routing protocol, destination Sequenced Distance Vector Routing, Distance Routing Effect algorithm for mobility and Simple Forwarding over Trajectory. Ant Colony and Particle Swarm

Optimization Algorithms are used to find multiple paths to avoid link failure.

Vehicular Ad-Hoc Network gives capacity to remotely impart between vehicles. Arrange fracture, visit topology changes and constrained scope of Wi-Fi is issues in VANETS that emerge on account of the nonattendance of central manager entity. Due to this steering, the packets inside the system are troublesome. The Optimized Link state directing is a notable versatile Ad-hoc arrange steering convention. Here we are utilizing OLSR convention utilizing meta-heuristic technique. The recreation comes about demonstrated better contrasted with the current approach.

Vehicular Ad-hoc Networks demonstrate exceedingly dynamic conduct with high versatility and irregular system topologies. The execution of Transmission Control Protocols in such remote appointed systems is tormented by various issues like visit interface disappointments, versatility, multi-bound information transmission and information misfortune. In this work, we make utilization of the vehicles development design, vehicle thickness, vehicle speed and vehicle blurring conditions to build up a half and half, multi-way ant colony algorithm [7], mobility Aware Zone based Ant Colony Optimization Routing for VANET (MAZACORNET) that presentations domain and flexibility. We use ACO to find various routes between centre points in the framework to help in association dissatisfactions. To fulfil flexibility, we send the framework into different zones. We utilize proactive way to deal with oversee discover a route inside a zone and responsive way to deal with oversee discover route between zones utilizing the region data set away in each zone thus attempting to diminish broadcasting and discourage. Our proposed approach makes sensible use of the structure transmission utmost is an adaptable and is powerful to interface disappointments. The results exhibit that the computation capacities honourably for thick frameworks. The estimation makes better transport extent and is versatile for zones past four. Right when appeared differently in relation to other existing VANET protocols, the crossbreed estimation ended up being more compelling in regards to package movement extent and end to end delay. To the extent anybody is concerned this is the primary creepy crawly based controlling computation for VANET that uses zones.

In Wireless Sensor Network (WSN), routing is a testing assignment because of movement and system measure. To course the quantity of bundles in WSN, the thought is to consider about Zone Routing Protocol (ZRP). The primary half and half directing convention having proactive and receptive components was ZRP. Reconfigurable Wireless Networks has a capacity to remake its systems if arrange crash happens and ZRP take after, profoundly portable condition and it improves abilities of proactive convention steering conventions and as a result of increment in the look of course per time for same course or distinctive inactivity abatements of responsive convention. It is vital to break down the adaptability attributes of the directing conventions as for these parameters. To shield from the stealthier form of sinkhole assaults in ZRP, sinkhole indicator is utilized so that execution of system increments.

Another approach for laying out a versatile fluffy model judicious control (AFMPC) in perspective of the underground insect state headway (ACO) is proposed. On-line adaptable fluffy recognizing evidence is familiar with perceive the structure parameters. These parameters are utilized to handle the target work in light of a farsighted technique and structure of RST control. By then the streamlining issue is unravelled in light of an ACO tally, utilized at the overhaul methodology in AFMPC to pick consummate controller parameters of RST control. The utility of the proposed controller is showed up by applying it to two nonlinear strategies, where the proposed approach outfits good presentations differentiated and relative fundamental underground subterranean insect settlement enhancement controller and flexible fluffy model farsighted controller.

Late disseminated figuring advancements are arranged towards availability and steadfastness in the adaptable conditions. For data openness, duplication is for the most part used as a piece of scattered circumstances to diminish the get the chance to cost and upgrade the general execution. This paper addresses the one of the rule issues in keeping up consistency in copy association especially; useful neighbourhood consistency association utilizing Optimized Distributed Spanning Tree models. The proposed approach prompts keep up the appropriate neighbourhood consistency in the Ad-hoc Networks. This paper reviews the capacity of existing systems close-by the proposed approach in the perspective of driving the proposed show up and the empowering comes about strengthen the same.

The current review concentrates on to demonstrate the advantages of scattered covers over conventional ones as far as solidness, locking resistance and quality in basic applications. The Ant Colony Optimization [8] calculation is utilized with quality limitations to locate the best answer for accomplish this objective. A review is taken to choose the most appropriate disappointment cases among three same ones. The procedure is utilized for two stacking cases: biaxial pressure and biaxial strain. In biaxial pressure, the issue is figured to extend the essential fastening load while with the biaxial strain the definition is to confine the failure document. For both stacking cases, the technique wins with respect to upgrading the response of scattered overlays concerning the standard ones. These results support the improvement of the composite business toward using scattered spreads.

III. PROBLEM DEFINITION

This paper goal is to make a comparative analysis of various soft computing algorithms. By using the Warshall Floyd, we will find the shortest path to the destination.

Definitions which are related to our model are categorized into sets. First set consist of the definitions about various soft computing algorithms and other set shows the definitions regarding the Warshall Floyd.
The following are definitions corresponding to the set 1:

Definition 1: Ant Colony Optimization Algorithm (ACO). In this present reality, ants meander haphazardly, and subsequent to finding sustenance return to their settlement while setting down pheromone trails. In case unique ants find such a way, they are likely not to keep going erratically, yet rather take after the trail laid by before ants, returning and reinforcing it if they over the long haul find support. After some time, be that as it may, the pheromone trail begins to vanish, along these lines diminishing its appealing quality. The additional time it takes for an ant to go down the path and back again, the extra time the pheromones need to disperse. A short route, by connection, gets strolled over faster, and consequently the pheromone thickness remains high. Pheromone vanishing has likewise the upside of staying away from the meeting to a locally perfect game plan. If there was no scattering by any methods, the routes picked by the essential ants would tend to be excessively charming to the going with ones. In light of current circumstances, the examination of the course of action space would be constrained. Subsequently, when one ant finds a not too bad (short) route from the state to a food source, diverse ants will likely take after that way, and such positive feedback at last leaves each one of the ants taking after a lone way. The likelihood of the creepy crawly area estimation is to duplicate this lead with "re-enacted ants" walking around the request space addressing the issue to be comprehended. Ant Colony optimization algorithm [11] has been used to convey closes perfect responses for the travelling salesman issue. The ant colony algorithm can be run persistently and can adjust to changes progressively. This is of enthusiasm for system directing and smart transportation frameworks.

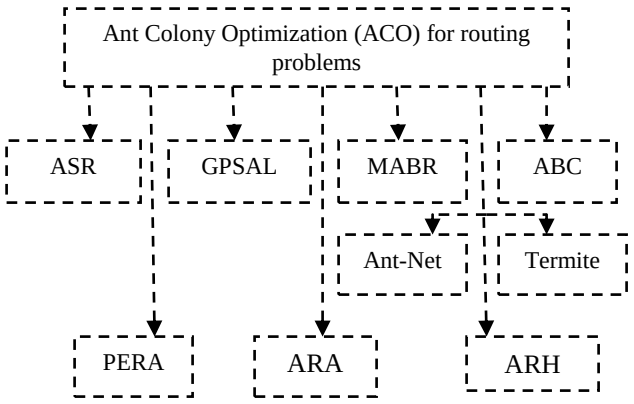

Figure 1. Ant Colony Optimization Algorithm for routing problem

Figure 1 depicts Ant colony Optimization Algorithm for routing.
ASR means Adaptive Swarm-based routing, MABR means Mobile Ant Based Routing, ABC means Ant-based control, PERA means Probabilistic emergent routing algorithm, ARA means Ant colony based routing Algorithm and ARH means Ants routing with Routing history.
As of late, more consideration has been paid to utilize system parameters when indicating directing measurements. Cases may incorporate postponement of the system, interface limit, and connect soundness or recognizing low portability hubs. There exists moderately little work concerning naturally roused calculations for steering in correspondences systems. The primary point is planned to fill in as a comprehensive manual for all conceivable and accessible writing that applying ACO calculations to tackle steering issues.

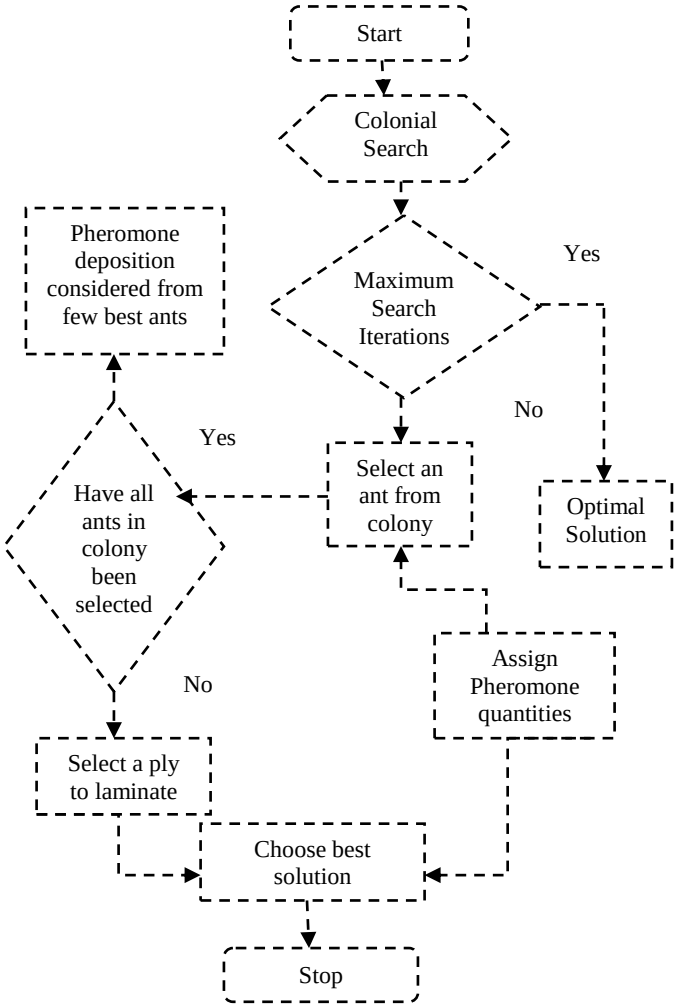

Figure 2. Flow Diagram for Ant Colony Optimization

Figure 2 depicts the flow diagram for the Ant Colony Optimization Algorithm. We will perform colonial search, based on that maximum iterations we will find the optimal solution or select an ant from the colony. If all the ants from the colony been selected then pheromone disposition considered from few best ants otherwise select a ply to

laminate. Assign pheromone quantities to the ants in the colony. Finally choose the best solution and stop the process.

Definition 2: Particle Swarm Optimization Algorithm (PSO). PSO was initially portrayed by James Kennedy and Russell Eberhart in 1995. PSO is gotten from two ideas, for example, the perception of swarming propensities for creatures, for example, fowls or angle and the field of developmental calculation, for example, hereditary calculations. The PSO calculation mainatins numerous potential arrangements at one time. Amid every emphasis of the calculation, every arrangement is assessed by a target capacity to decide its wellness. Every arrangement is spoken to by a particle in the wellness scene. The particles "fly" or "swarm" through the hunt space to locate the most extreme esteem returned by the goal work. Every particle keeps up: position in the inquiry space, speed and individual best position. The swarm keeps up its worldwide best position. The PSO calculation keeps up three stages: assess wellness of every particle, refresh individual worldwide bests, refresh velocity and position of every molecule. These means are rehashed until some ceasing condition is met.

PSO has been utilized by numerous uses of a few issues. The estimation of PSO duplicates from lead of particle social requests that don't have any pioneer in their get-together or swarm, for instance, winged particle surging and angle mentoring. Conventionally, a keep running of particles that have no pioneers will find food by unpredictable, tail one of the people from the social occasion that has the closest position with a sustenance source (potential game plan). The groups achieve their best condition in the meantime through correspondence among people who starting at now have an unrivaled situation. Particles which has a better condition will instruct it than its runs and the others will move in the meantime to that place. This would happen more than once until the best conditions or a support source found. The system of PSO estimation in discovering perfect qualities takes after the work of this particle society. Particle swarm Optimization involves a swarm of particles, where particle address a potential game plan.

Particle Swarm is reviving rapidly. The count of PSO duplicates from lead of particles social requests that don't have any pioneer in their get-together or swarm, for instance, winged particle running and fish coaching. Usually, a surge of particles that have no pioneers will find food by subjective, tail one of the people from the social affair that has the closest position with a sustenance source (potential course of action). The gatherings achieve their best condition at the same time through correspondence among people who starting at now have an unrivaled situation. Particles which has a better condition will light up it than its runs and the others will move at the same time to that place. This would occur on and on until the best conditions or a support source found. The system of PSO count in discovering perfect qualities takes after the work of this particle society.

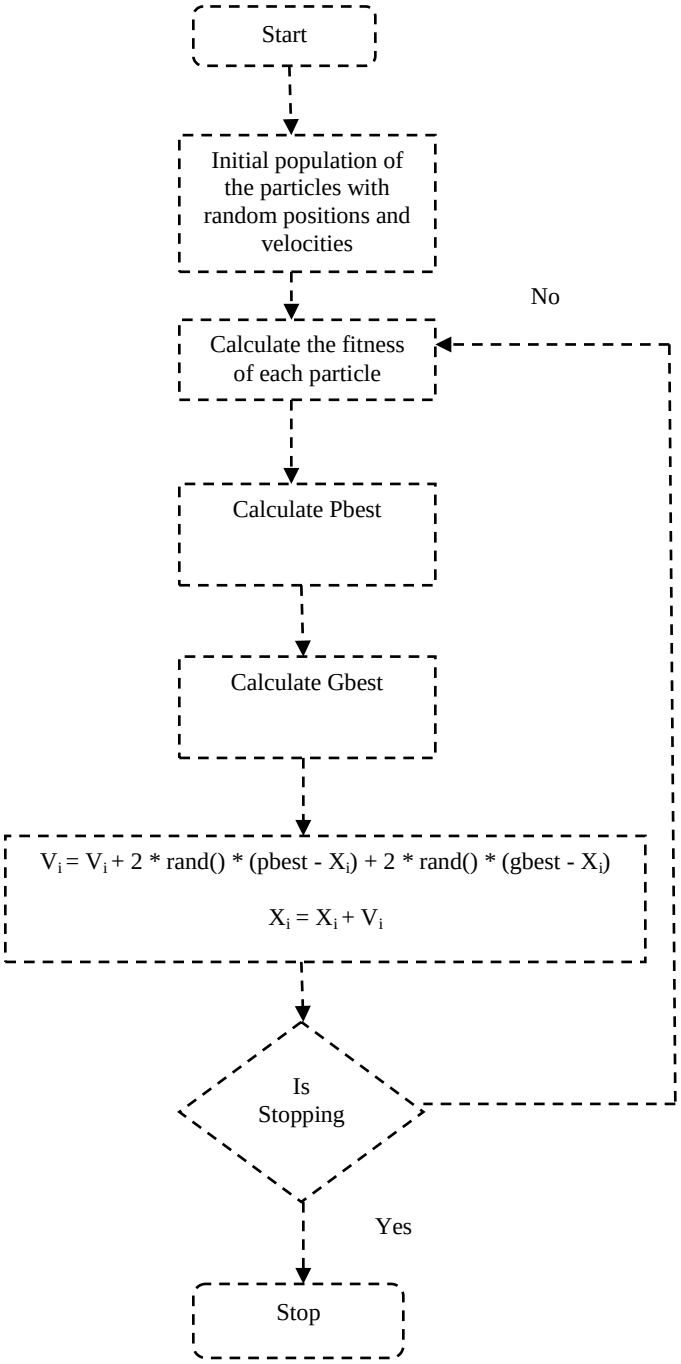

Figure 3. Flow Diagram for Particle Swarm Optimization Algorithm

Figure 3 depicts the flow diagram for Particle Swarm Optimization algorithm. We will introduce the number of inhabitants in the particles with irregular positions and speeds. Compute the wellness of every molecule. Get Pbest, it is the every molecule's best postion. Get Gbest, it is the any molecule's best postion. Ascertain Vi, it is the speed of the vector. Figure Xi, it is the position vector. Stop the procedure

when the ceasing criteria is met generally rehash the procedure from the earliest starting point.

Definition 3: Artificial Bee Colony (ABC). In ABC calculation, the area of reenacted honey bees includes three get-together of honey bees: used honey bees, observers and scouts. In the first place half of the region contains the used fake honey bees and the second half joins the onlookers. For every source, a solitary used honey bee is present. Toward the day's end, the amount of used honey bees is proportional to the amount of sustenance sources around the hive. The used honey bee whose the sustenance source has been surrendered by the honey bees transforms into a scout. In ABC calculation, the position of a support source addresses a probable response for the improvement issue and the nectar measure of a sustenance source identifies with the quality (health) of the related course of action. The amount of the used honey bees or the bystander honey bees is comparable to the amount of courses of action in the people.

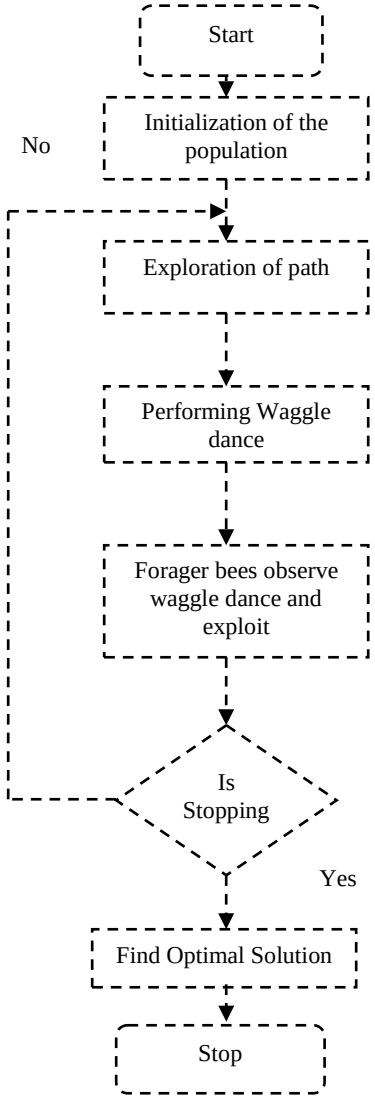

Figure 4. Flow Diagram for Artificial Bee Colony Algorithm

In ABC calculation, the state of simulated honey bees comprises of three gatherings of honey bees: utilized honey bees, spectators and scouts. Initially 50% of the settlement comprises of the utilized counterfeit honey bees and the second half incorporates the spectators. Here, there is just a single utilized honey bee. As such, the quantity of utilized honey bees is equivalent to the quantity of sustenance sources around the hive. The utilized honey bee whose the nourishment source has been surrendered by the honey bees turns into a scout. The position of a nourishment source speaks to a conceivable answer for the advancement issue and the nectar measure of a sustenance source relates to the nature of the related arrangement.

In the below figure depicts the flow diagram for Artificial Bee Colony Algorithm. We will initialize the population, and then exploration of the path is done. Performing waggle dance based on that forager bees observe waggle dance and exploit. If the stopping criteria is met, then find the optimal solution to the destination otherwise repeat the process from the beginning.

The following are definitions corresponding to set 2:

Definition 1: Shortest Path Algorithm. The shortest path problem is the issue of finding a way between two vertices (or hubs) in a diagram with the end goal that the entirety of the weights of its constituent edges is limited. The issue of finding the shortest path between two convergences on a guide might be displayed by a unique instance of the most limited way issue in diagrams. There are numerous calculations used to locate the most limited way. In this paper, we are utilizing Warshall Floyd to locate the ideal way to the goal.

Definition 2: Warshall Floyd. It is a technique which is utilized to locate the briefest ways among all sets of hubs in a chart, which doesn't contain any cycles of negative length. The fundamental favorable position of this calculation is its effortlessness. It belongs to dynamic programming problem. It recursively defines the value of the optimal solution. The optimal solution is found in bottom-up manner. Applications include detecting negative cycle, transitive closure of a directed graph.

IV. PRPOSED FRAMEWORK

In this section, our proposed methodology is discussed.

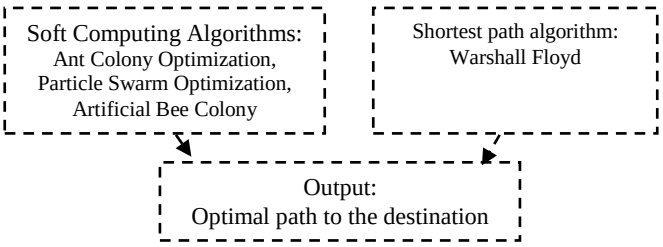

Fig.5 Architecture of Proposed Model

Figure 5 depicts the architecture of our proposed model. There are two inputs provided to the system. One is the soft computing algorithms like Ant Colony Optimization, Particle Swarm Optimization and Artificial Bee Colony. Another input is shortest path algorithm i.e. Warshall Floyd Algorithm. By providing theses as inputs we get shortest path to reach the destination and it the optimal one. The proposed method gives better results compared to the exisiting approach.

Table 1. Proposed Algorithm

Algorithm
Step1: Choose the driver terminal.
Step2: Find all the possible routes to the destination.
Step3: The terminal reaches destination then keep in the same route, otherwise finding the other possibility to the destination.
Step4: If there is any possibility to the destination, then assign a new route towards the destination.
Step5: No route to the destination then probabilistic assignment of a new route towards another input street.
Step6: Find the optimal path to the destination by Warshall Floyd Algorithm.

In the above table, proposed algorithm is shown. We will choose the driver terminal. We will find all the possible routes to the destination. The terminal reaches the destination then keep in the same route, otherwise finding the other possibility to the destination. If there is any possibility to the destination, then assign a new route towards the destination. No route to the destination then probabilistic assignment of the new route towards another input street. For getting feasible route to the destination then one of the algorithms like ant colony optimization, particle swarm optimization or artificial bee colony algorithms are used. Find the optimal route to the destination by the all pair shortest path algorithms like Warshall Floyd algorithm. So by this we are able to find the optimal path to the destination.

V. APPLICATIONS

Ant colony optimization have been connected to numerous combinatorial streamlining issues like directing vehicles, stochastic issues, multi-targets and parallel use. It is moreover used to make perfect responses for the travelling sales man problem. The ant colony optimization may change powerfully, runs constantly and adjust to changes continuously.

Particle swarm optimization is a field in neural network. There are numerous application zones of this calculation like broadcast communications, control, information mining, outline, combinatorial enhancement, control frameworks, flag handling, and numerous others. PSO primarily fathoms unconstrained, single-target enhancement issues. PSO was created to deal with constrained issues, multi-target progression issues, issues with capably changing scenes and to find various courses of action.

Artificial bee colony algorithm is quick and the outcomes are especially dependable in finding ideal arrangements. Less parameter taking care of, basic dissecting of the issue is imperative piece of ABC calculation. The viable use of ABC calculation is supply framework.

Warshall Floyd can be utilized to take care of the accompanying issues like discovering shortest paths in coordinated charts, transitive conclusion of coordinated diagrams, finding a standard expression, reversal of genuine grids, ideal directing, quick calculation of pathfinder systems, largest ways/greatest data transmission ways and figuring authoritative type of distinction bound frameworks.

VI. RESULTS AND ANALYSIS

In this section, a graph is bar chart is drawn to show the best path among the three algorithms. We found for Ant Colony Optimization Algorithm the estimated value is 0.0006, for the Particle Swarm Optimization Algorithm the estimated value is 0.000151 and the Artificial Bee Colony Algorithm the estimated value is 0. This shows that the best algorithm to be chosen is Artificial Bee Colony Algorithm.

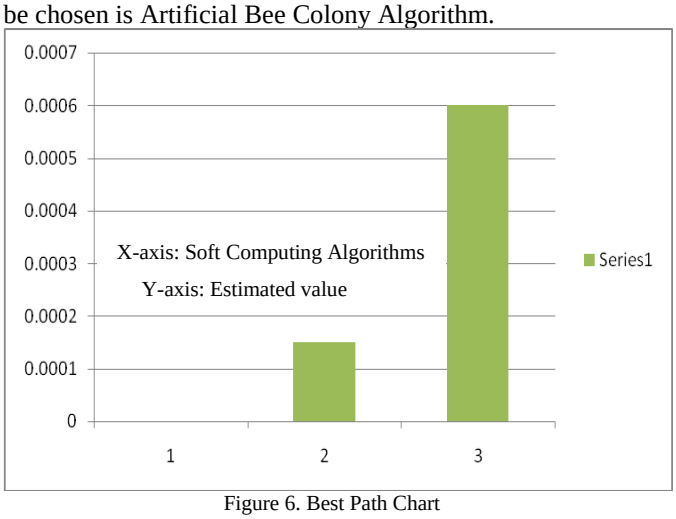

Figure 6. Best Path Chart

VII. CONCLUSION

This paper proposed a comparative analysis of various soft computing algorithms and deals with finding the optimal path to the destination by Warshall Floyd algorithm. The results of the soft computing algorithms like Ant Colony optimization algorithm, Particle Swarm optimization algorithm and Artificial Bee colony algorithm works well for Vehicular Ad-hoc networks. The proposed algorithm showed better results compared to the existing algorithms. The performance parameters like Delay, Jitter and Throughput are calculated. The path to the destination is optimized by using shortest path algorithm like Warshall Floyd.

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