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Improved Vehicular Information Network Architecture Using Named Data Networking Based On Fuzzy Logic

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ABSTRACT
IOT features created various new information parts in addition to one of the parts are usually vehicular info network where many cars and products are participating with huge info exchange. The high information management as well as minimal transmission efficiency sustained in the vehicular information network is challenging the investigators to analyze more cost-effective and scalable network architectures along with transmission schemes. The study indicates that the NDN has better results but it can be improved further by utilizing optimistic decision making. This paper mainly focuses on vehicular information network in which various forms of vehicles and products are involved by utilizing Internet of things (IOT) and fuzzy logic in VANETS which further improves the vehicular information system.
Keywords: IOT; Fuzzy membership function; NDN; VANETS; Data aggregation; Mobility management

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I. INTRODUCTION

The ad-hoc system is usually a decentralized sort of wifi network. The network is ad-hoc mainly because this doesn't make use of a pre-existing system. Instead, each and every node participates in routing by means of forwarding details to alternative nodes, to ensure the determination that nodes sends detail is manufactured dynamically dependent on network connections as well as the traditional routing, ad hoc networks is able to use flooding regarding sending the actual data.[1] An ad hoc n/w usually relates the networks exactly where many systems have same position on a network and therefore are able to accompany any ad hoc network systems inside web link range [1]. Another number of wireless network, infrastructure a lesser amount of sites, is usually knows as Mobile Ad-hoc networks (MANET).The MANET is mostly considered the network which has a lot of free nodes generally is made up of mobile devices or another cell phone items that will organize by themselves inside several ways along with run without strict top-down network administration [2].

A. Vehicular Ad-hoc Networks (VANETS)

VANET is the technology which combines the particular abilities of recent age group mobile networks to vehicles. VANET creates an effective Ad-Hoc network in between moving automobiles and roadside units. It is really a type of MANET which ensures connection between automobiles and surrounding fixed device, commonly often called roadside apparatus.. Security and traffic Administration includes actual time details and has an effect on lifestyles of people going to the road. Safety is usually realized as the best feature regarding VANETs. Most nodes around VANET are usually vehicles that are capable of making self applied networks without preceding information of any other. VANET along with reduced safety levels will be weaker to be able to consistent attacks [3].

VANETs contain following entities:

- Access point:-The access points tend to be fixed along with frequently connected to the internet. V2V transmission has got two kinds of transmissions single hop and multi hop [3].
- Vehicle:-Vehicle is usually nodes associated with vehicular network. VANET addresses the particular wireless network transmission concerning vehicles (V2V) as well as vehicles and infrastructure access point [3].

B. Data Aggregation

A vehicle receives information and facts through remote vehicles or nearby sensing unit observations. The details received in form of information is then processed inside the particular vehicle and subsequently disseminated to help direct neighbor vehicles. Nearby vehicles use exactly the same scheme, thus accomplishing good implicit multi hop dissemination [4].

Inside an automobile, an aggregation scheme can possibly be properly explained by four tasks in addition to respective components.

1. Decision In this job a decision is created if the data items may be aggregated.
2. Fusion: In this task many data items are merged together.
3. World Model: This is actually the stage where the world model is maintained that consists of received information in addition to the self-obtained information.
4. Dissemination: In this stage the world models are disseminated to one other vehicle.

C. Fuzzy Membership Function

Fuzzy classification is one of the uses of fuzzy logic which is definitely utilized to take care of classification problems. In development of fuzzy classification technique, the main step is to build member function and then to find out several ideal fuzzy rules within the fuzzy classification technique [5]. Fuzzy membership functions and fuzzy rules can be designed by to skilled understanding technique along with other substitute will be utilizing data driven approach. All these techniques concur either to manual or even automatically by using a device learning method devoted to exercising situations correspondingly, Mostly skilled understanding is used to prepare membership functions and if then rules for inference as well as it is an advantage since it has got link to domain understanding however it may be very subjective along with different authorities generating several membership functions as well as regulations to get the exact same application. Another method for creation of fuzzy membership functions by a input data can transform crisp information into linguistic terms [5].Fuzzy logic concept is usually compared with human sense as well as inference process. Not like classical manage technique, that really is actually a link-to-link manage, fuzzy common sense manage is actually a range-to-point or even range-to-range manage [6]. The actual output of fuzzy controlled arises from fuzzifications associated with equally inputs as well as outputs while using the associated member functions. The crisp input may be changed into distinct members of this linked regular membership functions predicated their value. To apply fuzzy logic process to an actual real program needs three steps:

1. Fuzzifications – transfer common info or even crisp detailed info directly into fuzzy information or simply Membership functions (MFs) [5].
2. Fuzzy Inference Process – put together regular membership functions with control principles to be able to get the particular fuzzy output [6].
3. Defuzzification - apply different strategies to determine every related end result in addition to place them in to a table. Pick-up the results by lookup table using the specific input throughout the application [5].

II . LITERATURE SURVEY

Xue yang, et al. [5] represents a new vehicle-to-vehicle transmission process related to cooperative smashup extreme caution on this ,so it specifies a fresh process for low-latency around offering unexpected urgent situation alerts within way situations. Azim Eskandarian, et al. [6] surveyed troubles with Inter auto ad-hoc system to create system operation this investigates the specific consequence of your disparities in regards to the IVC connection architectural mastery, such as essential health conditions significance**.** Zhao Zing, et al. [7] represents troubles of Intervehicle ad-hoc network to produce network functionality and this examines the specific effect of your differences about the IVC communication architecture, such as essential health concerns ramifications**.**. Marco Dorigo, et al. [8] introduces the Ant Colony Optimization and defines the several uses of it. Fethi Filali, et al. [9] represents the exact principle for we've got the technology of vehicular mobility models. It provides taxonomy of a large selection of mobility models made for VANETS in addition to eventually identifies the main one essential for their needs. Giulio, Grassi et al. [10] apply the Named Data Networking; a new newly offered Internet buildings, so that you can network automobiles for the run. This specific paper represents a new prototype implementation connected with V-NDN as well as initial performance diagnosis, plus identifies staying problems.Raj K.Shrestha, et al. [11] proposed multi hop represents the exact principle for we've got the technology of vehicular mobility models. It provides taxonomy of a large selection of mobility models made for VANETS in addition to eventually identifies the main one essential for their needs, Wischhof et al. [12] represents a technique for scalable information dissemination in highly mobile adhoc networks, it proposes method oriented data abstraction and dissemination (S0DAD) with this method one application is presented i.e. self-organizing traffic-information system (SOTIS). Saleh, Yousefi et al. [13] it presents the detailed study linked to challenges throughout with your networks that goals the various dilemmas in addition to solutions. It's features which can be various coming from simple MANETS. Tarik, Taleb et al. [14] suggested

the utilization of precisely cars action data to know a possible link breakage. The system used behind is to deliver just unique and well known boxes called as most readily useful packets.

III. GAPS IN LITERATURE

As discussed by Zhiwei Yan [4], it's noticed that NDN produced a vehicular network depending on the fundamental transmission theory of naming conventions of nodes. The idea improved content naming, addressing, data aggregation as well as mobility regarding IVC within the VANETs So there are few areas where further improvements are possible. The review has shown that the NDN has better results but can be improved further by using optimistic decision making. The use of Internet of things (IOT), effect of vehicular speed and fuzzy logic in VANETS is ignored in the existing work. We'll propose novel vehicular information network based upon fuzzy membership function that will expands the fundamental NDN design to raised support area dependent forwarding, content aggregation as well as distributed mobility management.

IV. RESULTS

A. PROPOSED ALGORITHM

1. Deploy VANET nodes randomly

$$node(i1,1)$$

Where n11 denotes the number of VANET devices to be deployed and i1 is counter initialized to 1.

2. Deploy RSU
3. Evaluate fuzzy membership functions

3.1 **Trapezoidal MFs**

A trapezoidal MF is specified by four parameters {a, b, c, d} as follows:

$$trapezoid(x;a,b,c,d) = max\left(min\left(\frac{x-a}{b-a},1,\frac{d-x}{d-c}\right),0\right)$$

The parameters {a, b, c, d} (with a < b <= c < d) determine the x coordinates of the four corners of the underlying trapezoidal MF.

3.2 Generalised bell MFs

$$bell(x;a,b,c) = \frac{1}{1+|\frac{x-c}{a}|^{2b}}$$

4. Define multicast Vanets

$$cn1 = \frac{\Sigma(x)}{n}$$

$$cn2 = \frac{\Sigma(x)}{n}$$

10 active VANET nodes were taken. One Controller node was placed at position (cn1, cn2).

5. Assign VANET between user and controller node

$$assign\_iot(i,[oint1,cn1],[oint2,cn2],'k')$$

This is function that was used to start transfer of data packets between VANET nodes and user through controller node where (oint1, oint2) denote the user position in the setup.

5.1 Evaluate distance
5.2 Assign work to Vanets
5.3 Send back from Vanets to server(s)
6. Stopping criteria
7. Evaluate parameters

B. PROPOSED METHODOLOGY

1.To initialize the process.
2.Then to evaluate vehicular.
3.Apply lower level aggregation
4.Then compressive sensing based NDN Router is applied.
5.Then Upper level aggregation is performed.
6.Evaluate performance metrics.
7.End

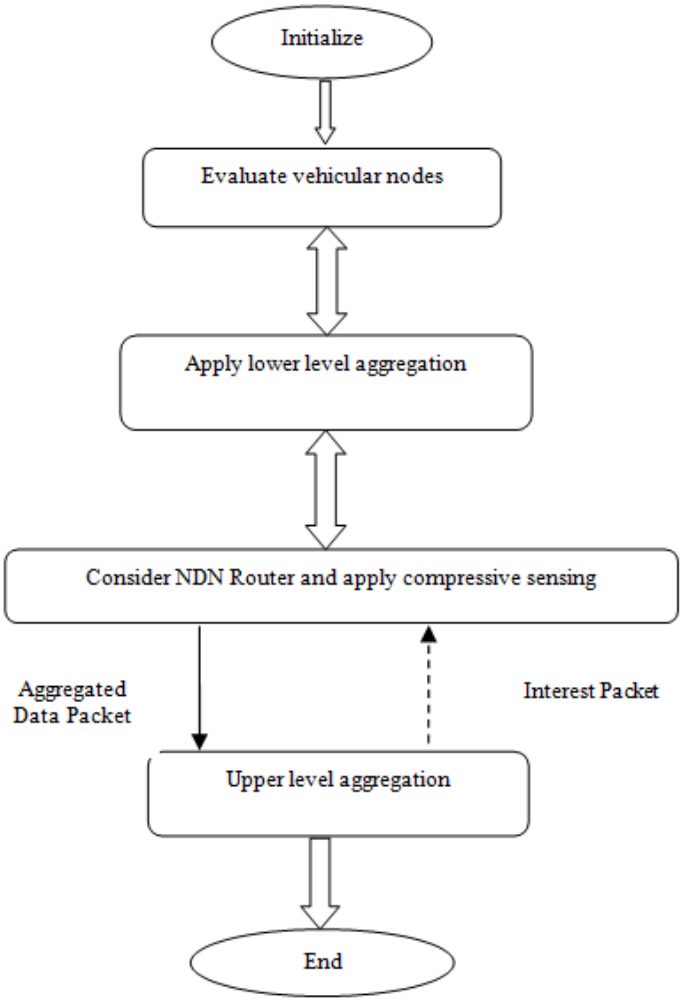

Fig 1: Flowchart of the proposed technique

C. PERFORMANCE ANALYSIS

This paper has designed and implemented the proposed technique in MATLAB tool u2013a. The evaluation of proposed technique is done on the basis of following metrics i.e. overhead; energy consumption and time to live depends on the speed of vehicles. A comparison is drawn between our proposed technique and the existing work carried by Zhiwei Y. & Sherali Z. [4].

1. Overhead

Overhead is usually indicated that combination of extra or even oblique computation period, storage, data transfer rate or some other assets which are necessary to obtain a specific outcome. In Table I,it is observed that the control overhead proposed in a technique has shown significant improvement over the existing technique.

Table I: Overhead (time in seconds)

Speed of vehicles	**Overhead (zhiwei & Sherali[4] approach)**	**Overhead (Proposed technique)**
10	2.3997	2.2106
20	4.2096	3.7713
30	6.3320	5.6371
40	8.7309	7.7688
50	11.3744	10.1405
60	14.2432	12.7258
70	17.3116	15.5046
80	20.5438	18.4715
90	23.9376	21.6016
100	27.5160	24.8954

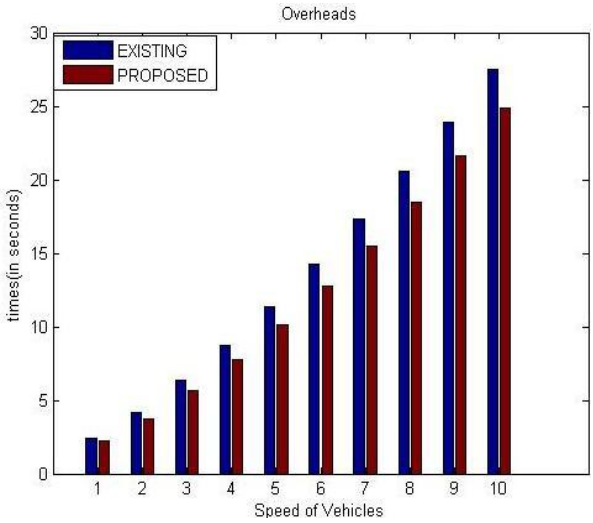

Fig 2: Overhead **(**time in seconds)

Fig.2: shows the comparison of Control Overhead between existing and also the proposed method wherever x-axis shows the vehicles speed and y- axis values shows time. In our case the proposed overhead are comparatively lower than the Zhiwei Y. & Sherali Z. [4].

2. Energy consumption

Energy consumption is the amount of energy or power used..In Table II ,it is observed that the energy consumption proposed in a technique has shown significant improvement over the existing technique.

Table II: Energy consumption

Speed of vehicles	Energy consumption (zhiwei & Sherali[4] approach)	Energy consumption (Proposed technique)
10	1.6112	1.4843
20	2.8256	2.5316
30	4.2498	3.7835
40	5.8594	5.2139
50	7.6332	6.8053
60	9.5582	8.5400
70	11.6171	10.4046
80	13.7859	12.3954
90	16.0631	14.4956
100	18.4643	16.7058

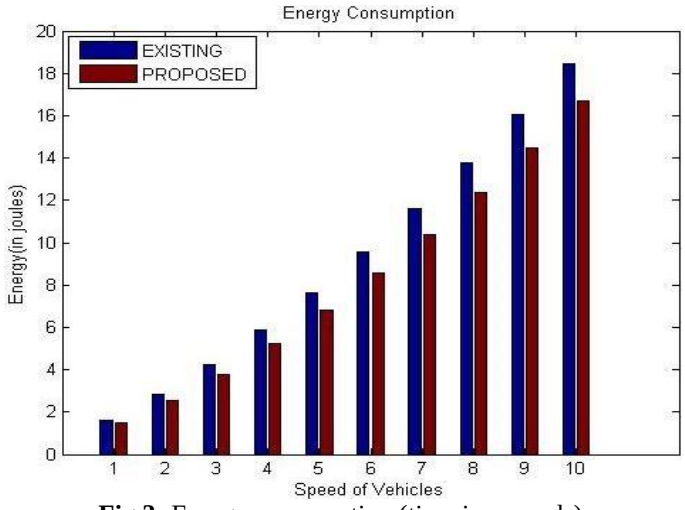

Fig 3: Energy consumption (time in seconds)

Fig.3: shows the comparison of aggregation time between existing and also the proposed method where x-axis shows the vehicles speed and y- axis values shows time. In our case the proposed Energy consumption is comparatively lower than the existing approach.

3.Time to Live

Time to live (TTL) is really a process which restricts this life and also duration of facts throughout a computer and also network. TTL could possibly be carried out as a timestamp mounted on and also embedded in this data. Once the prescribed function timestamp features elapsed, details are discarded. TTL is familiar with increase performance connected with caching and to increase privacy.In Table III, it is observed that the time to live proposed in a technique has shown significant improvement over the existing technique.

Table III: Time to live (time in seconds)

Speed of vehicles	Time to live (zhiwei & Sherali[4] approach)	Time to live (Proposed technique)
10	0.9399	0.7236
20	2.5950	2.1308
30	3.6680	2.9459
40	4.7120	3.7229
50	5.7437	4.4817
60	6.7693	5.2238
70	7.7874	5.9528
80	8.7768	6.6781
90	9.7526	7.3882
100	10.7368	8.0941

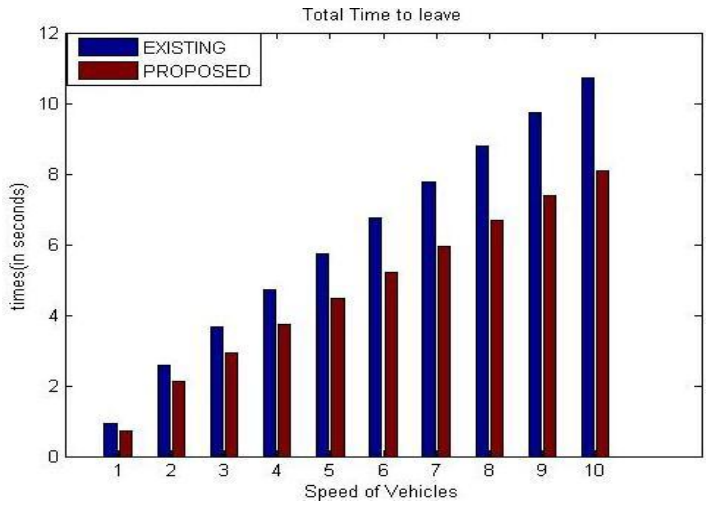

Fig 4: Time to live (time in seconds)

Fig.4: shows the comparison of Time to live between existing and also the proposed method wherever x-axis shows the vehicles speed and y- axis values shows time. In our case the proposed time to live are comparatively lower than the existing approach.

V. CONCLUSION

In this paper, we have analyzed existing 'Vehicular Information Network on the basis of Named Data Networking (NDN)'. The proposed vehicular information architecture based on fuzzy membership function gives better results. This paper has shown comparison between exiting and proposed vehicular information network architecture on the basis of parameters like optimal value of aggregation time, optimal value of number of locations, Time to live, Overheads. This proposed technique novel vehicular information network based on fuzzy membership function shows better results as compared to the existing technique. In near future we will try to enhance the results further by using the different fuzzy membership functions. Also further enhancement can also be done by utilising type 2 fuzzy membership functions.

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