International Journal of Scientific & Engineering Research -IJSER, Volume 11, Issue 9, September 2020
ISSN 2229-5518

Provide Emergency Ambulance Service in Road Accident Using VANET

Tanjima Hossain, Khandaker Takdir Ahmed, Md. Jashim Uddin

Abstract: This Proposal is subjected to the road scenario of Bangladesh. The high rate of causalities from accidents in Bangladesh is unacceptable. Every day around eight people die in road accidents. A lot of people die due to the lack of timely response after accidents. In this paper, we are proposing a model where people get emergency ambulance services and medical support as soon as possible after any accident occurs in the highways. In this model, we use VANET to transmit the distress signal to centralized managing system with the help of RSU (Road Side Unit). We leverage the VANET protocol along with the road side units to minimize response time of ambulances. Moreover, we can add more parameters to our proposed model in future, such as automated alert system using AI, with ambulance take help from philanthropic individuals etc.

Keywords: Ambulance service, centralized infra, Distress signal, Highway model, LTE network, Road Side Unit (RSU), VANET.

1. INTRODUCTION

Vehicular Ad Hoc Network (VANETs) is an innovation that coordinates the abilities of new-age remote systems to vehicles. VANET fabricates a strong Ad-Hoc arrangement between portable vehicles and side of the road units.[1]

Accident prevention has always been an important the issue for governments and car manufacturers across the world. The number of road crashes and deaths saw a **"Alarming Rise**" last year compared to the previous year. **At least 5,227 people were killed while 6,953 injured in 4,702 road accidents across in Bangladesh in 2019 (Source: The Daily Star, January 04, 2020).** Most of the victims who were killed in road accidents in 2019, more than 50 percent were pedestrians. For this reason, we proposed a model that improving road safety and save lives. Vehicular ad hoc network, comprising of a network of vehicles, moving at a generally fast, that communicate among themselves with various reasons for existing, being the fundamental reason that of improving security on the road. VANETs empower a wide scope of utilizations, for example, avoidance of impacts, wellbeing, daze crossing, dynamic course planning, constant traffic condition checking, and so on.

2. RELATED WORK

Proposing a solid and parameterization structure for maintaining a strategic distance from vehicle walker crashes utilizing VANET-foundation to LTE network communication to retrieve and infer the pedestrian's movements near the area surrounding the car's path. [2] Defining the collision zone, which is the area surrounding the car's path for which locations of pedestrians should be acquired from the LTE network. The coordinates and dimensions of the zone automatically adapt to the speeds of the car and pedestrians and the width of the road. proposing a versatile person on foot position revealing a plan that adjusts the recurrence of announcing dependent on the good ways from the VANET's side of the road unit, to which the vehicles report their areas and speeds, and from which they get cautions. Using On-Board Units (OBUs), vehicles can communicate with each other as well as with Roadside Units (RSUs) [3]. This is intended to diminish the heap in the LTE arrangement. Delivering test results utilizing the NS3 organize test system and the SUMO utility to have vehicles proceed onward streets of a chose map [4]. The performance of data dissemination in VANET terms of delivering an Emergency Warning Message (EWM) to vehicles in need, within the stipulated time, was assessed [5]. The outcomes represent the adequacy of the plan in identifying people on foot in the way of the vehicles.

3. DISPUTES IN VANET

Vehicular Ad Hoc Networks (VANETs) The systems that interconnect vehicles on the street is called Vehicular Ad hoc Networks (VANETs). A mobile ad hoc network (MANET) comprises portable hubs that interface themselves in as decentralized, self-organizing manner and may also establish multi-hop routes.[6] If versatile hubs are vehicles, this is called vehicular ad hoc network. The principal focus of research in VANETs is the enhancements in a vehicle well-being utilizing inter-vehicular communication (IVC). A few distinct applications are developing in VANETs. These applications incorporate security applications to make driving a lot more secure, versatile business, and other data

International Journal of Scientific & Engineering Research -IJSER, Volume 11, Issue 9, September 2020
ISSN 2229-5518

benefits that will illuminate drivers about any kind regarding clog, driving perils, mishaps, gridlocks. VANETs have a few unique angles contrasted with MANETs, in that the hubs move with high speed because of which the geography changes quickly. VANETs are additionally inclined to a few unique assaults. Along these lines, the security of VANETs is vital. VANETs present numerous difficulties in innovation, conventions, and security, which increment the requirement for research in this field. Vehicular ad hoc networks (VANETs) are required to help an enormous range of portable conveyed applications that run from traffic ready dispersal and dynamic course intending to the setting mindful notice and document sharing. Considering an enormous number of hubs that take an interest in these systems and their high portability, discusses still exist about the achieve ability of uses that utilization start to finish multi-bounce correspondence. The primary concern is whether the exhibition of VANET directing conventions can fulfill the throughput and postpone prerequisites of such applications. Investigations of conventional steering conventions for portable mobile ad hoc network (MANETs) exhibited that their presentation is poor in VANETs. The principle issue with these conventions, e.g., specially appointed on-request separation vector (AODV) and dynamic source directing (DSR), in VANET situations is their course flimsiness.[7] The conventional hub driven perspective on the courses (i.e., a setup course is a fixed progression of hubs between the source and the goal) prompts visit broken courses within the sight of VANETs' high portability, Thus, numerous parcels are dropped, and the overhead because of course fixes or disappointment warnings altogether builds, prompting low conveyance proportions and high transmission delays.

There are numerous elements engaged with a VANET settlement and organization. Even though most by far of VANET hubs are vehicles, different elements perform essential tasks in these systems. Also, they can speak with one another from multiple points of view. In this Section, right off the bat, a portrayal of the most normal elements that show up in VANETs is given. In the subsequent section, an examination of the diverse VANET settings that can be found among vehicles and the remaining substances are made.

3.1 Common VANET entities: Several different entities are usually assumed to exist in VANETs. To understand the internals and related security issues of these networks, it is necessary to analyze such entities and their relationships. Figure 1 shows the typical VANET scheme.

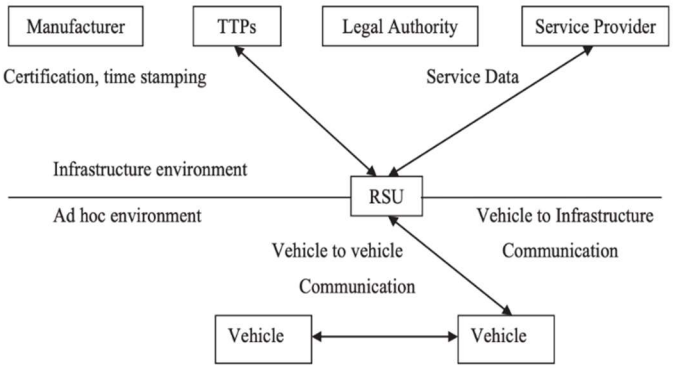

Figure 1: VANET model.

Ad-hoc environment in which, sporadic (ad-hoc) communications are established from vehicles. From the VANET point of view, they are equipped with three different devices. Firstly, they are equipped with a communication unit (OBU, On-Board Unit) that enables Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I, I2V) communications. [8] On the other hand, they have a set of sensors to measure their own status (e.g. fuel consumption) and its environment (e.g. slippery road, safety distance).

4. PROPOSED SYSTEM

A Vehicular Network (VANET) is a framework of Ad-hoc networks. VANET presents the infrastructure for scaling new methods to improve driving comfort and safety. Self-organizing VANETs formed between on-road vehicles equipped with wireless transmitters. So, vehicle networks are being enhanced as part of intelligent transportation services for significant upgrades to vehicle systems routines.

All this information gets exchanged through wireless communication between vehicles having On- Board Unit (OBU) and raises awareness on safety, especially as it concerns to vehicles in the rear can draw suitable conclusions before turning up at a disturbing location. Also, having information on the current situation on the highways makes it comfortable to drive. It offers options such as using a different route in case of traffic jams, thus lessening trip time and fuel consumption. Apart from road safety packets, RSUs assist in V2V communication, as shown in Figure 2. They can share music/videos and other data, including internet usage, road view maps, environmental climate

International Journal of Scientific & Engineering Research -IJSER, Volume 11, Issue 9, September 2020
ISSN 2229-5518

conditions, and toll information applications with the necessary quality metrics.

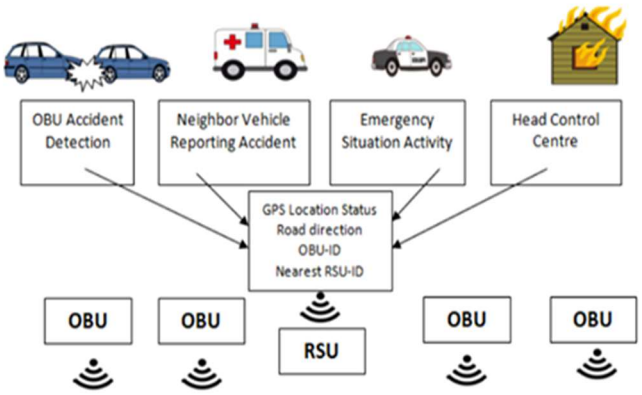

Figure 2: Architecture of proposed system.

5. PROPOSED METHODOLOGY

Accident detection and propagation This Proposal is subjected to the road scenario of Bangladesh. There are many scenarios that require attention. Among them, we are trying to address a scenario where-

- Accidents that happen in highways mostly late night and fast response by the ambulance service in unavailable [9]. In this particular situation vehicles that pass by the incident are most likely to ignore the accident. (As in late-night people are usually afraid to get out of their vehicles)

In our proposed solution there are a few requirements. IN the core of the system we need an accident detection device (ADD). To propagate the accident information, we need VANET along with Roadside units which have LTE which will communicate with centralized dedicated infra. ADD (accident detection device) will emit a distress signal (DISTRESS SIG).

DISTRESS SIG:

-Unique identifier (UUID)

-Timestamp (TM) and

-Longitude latitude information (LONG, LAT)

for each of the occurrence of an accident. After an accident occurs the passing vehicles would process this for a variable amount of time. Let's call it CUTT OFF TIME (let's say its 30 minutes). Each passing vehicle would keep the UUID of the accidents for MEMORY TIME (let's lay its 24 hours).

The workflow is:

5.1 Accident victim vehicle:

-Stop receiving ant signals.

- Send distress signal to passing vehicles until the ADD is switched off.

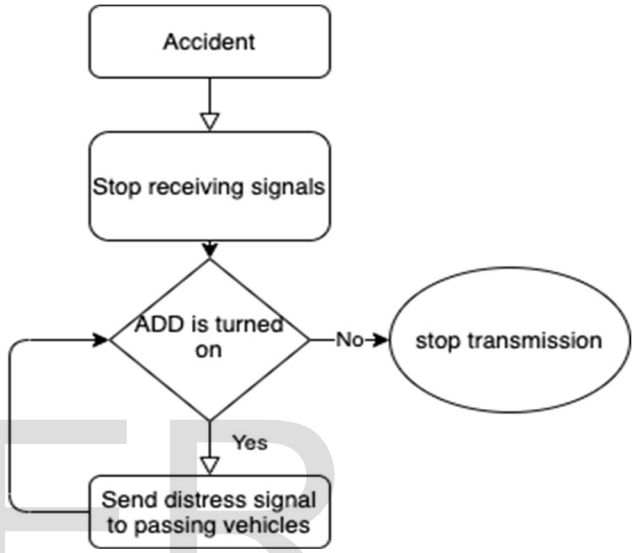

Figure 3: Accident victim vehicle flowchart.

5.2 Passing vehicles:

- Receive the signal from the victim vehicle, Ignore the already processed UUID.
- Pass the signal to nearby vehicles and RSU.
- For each of the pass DISTRESS SIG if CURRENT TIME TM < CUTT OFF TIME.
- Remove signal if CURRENT TIME TM > MEMORY TIME.

International Journal of Scientific & Engineering Research -IJSER, Volume 11, Issue 9, September 2020
ISSN 2229-5518

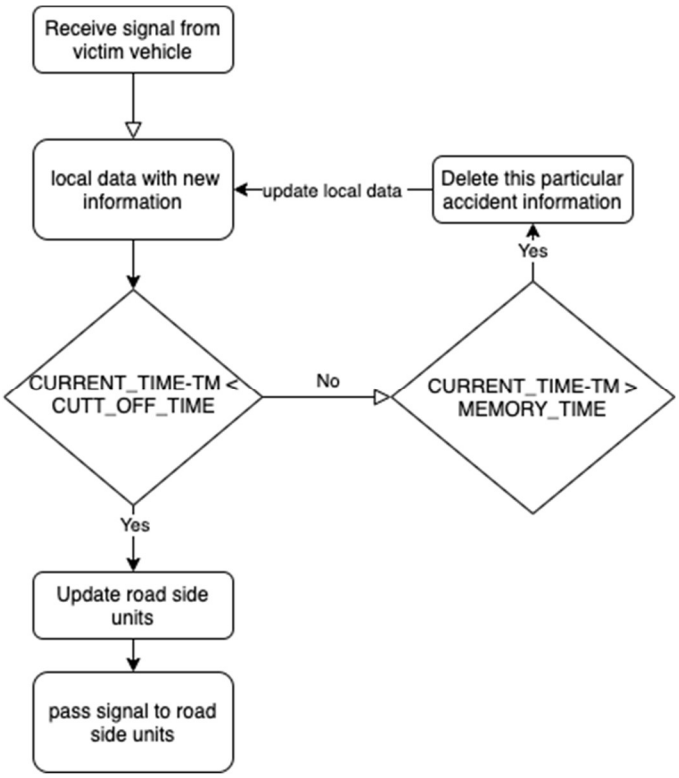

Figure 4: Passing vehicles flowchart.

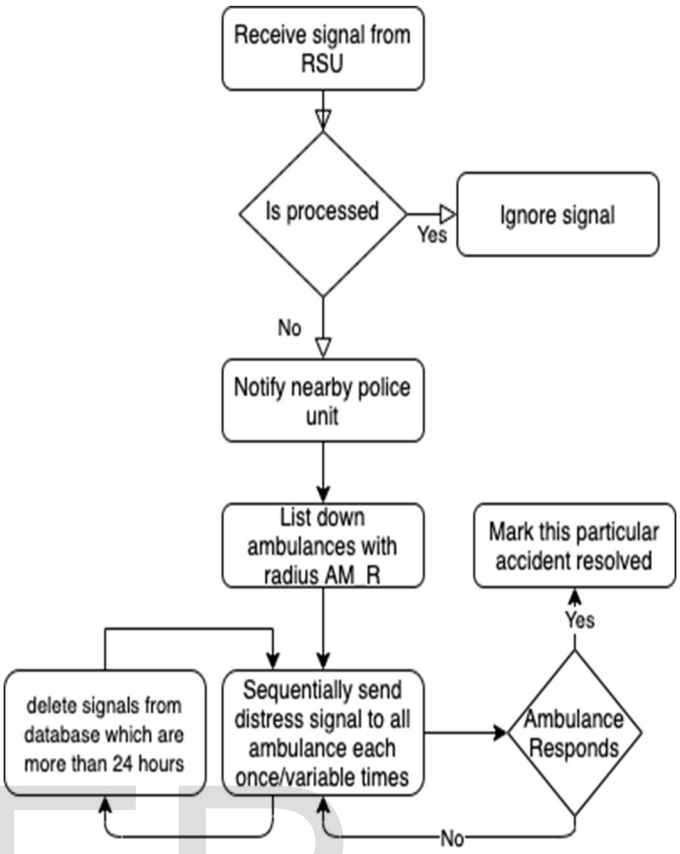

Figure 5: Road side unit's flowchart.

5.3 Roadside units and Centralized infra:

- Receive the signal from passing vehicles.
- Pass distress signal info the Centralized Infra

Centralized Infra:

- Receive the signal from RSU.
- If processed return response that already processed
- If not processed:
- Send a notification to the nearby police unit.
- List down all ambulance with a radius AMBULANCE RADIUS
- Send distress request to the Ambulance sequentially until an ambulance responds.
- Mark the distress if as resolved.

6. HARDWARE AND SOFTWARE REQUIREMENTS

6.1. Hardware Requirements:

- **Laptop.**
- **Vehicles:** Vehicles imply in or by which somebody voyages or something is conveyed or passed on; a method for movement or transport: an engine vehicle; space vehicles. a movement proceeding onward wheels, sprinters, tracks, or something like that, as a truck, sled, vehicle, or farm truck.
- **Ad-Hoc Network:** Specially appointed systems are made between at least two remote PCs together, without the utilization of a remote switch or a passageway.
- **ITS(Intelligent Transport System):-** An intelligent transportation system (ITS) is a propelled application that expects to offer creative types of assistance identifying with various methods of

International Journal of Scientific & Engineering Research -IJSER, Volume 11, Issue 9, September 2020
ISSN 2229-5518

transport and traffic the board and empower clients to be better educated and make more secure, progressively organized, and 'more brilliant' utilization of transport systems.

6.2. Software requirements:

- **Network Simulation Software:** A network simulation is the implementation of a simulation that attempts to imitate the real-world behavior of a computer network or certain aspects of a computer network to analyses the captured information and transmitted data. SUMO ("Simulation of Urban MObility") is a microscopic, inter- and multi-modal, space-continuous and time-discrete traffic flow simulation platform.[10]
- **Internet Connection:** The term "Internet connectivity" refers to the way people are hooked up to the Internet, and may include dial-up telephone lines, always-on broadband connections.
- **Radio Frequencies:** Radio frequency (RF) is the oscillation rate of an alternating electric current or voltage or of a magnetic, electric or electromagnetic field or mechanical system in the frequency range from around 20 kHz to around 300GHz.[11]

7. RESULT AND DISCUSSION

There were some simulations in a network simulator (NS-2.34) based on the average set vehicles with 200 seconds of time duration. To evaluate the output of the application, we tested the communication delay and data loss rate.

7.1 Packet Delivery Ratio:

Depend on network density, speed of vehicles, and coverage area packets affect delivery of packet towards receivers. Maxi- mum PDR signifies more reliable communication in a network.[12] The graph shows the high PDR for RSADP, same indicates the faster warning message dissemination occurred in V2I and V2V network. RSADP ensures the network provides safe and traffic managed driving on the road.

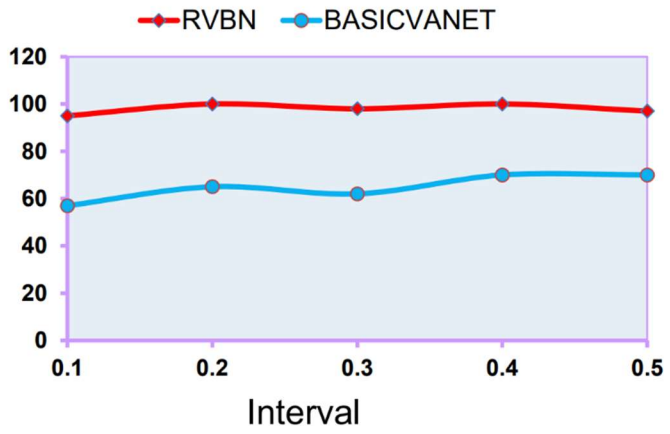

Figure 6: Packet Delivery Ratio.

7.2 Packet Dropped:

Figure 7 explains the average packet loss attained by the underlying VANET protocol against RSADP. The density of vehicles on the road affects the packet count in a network, in high-density vehicle scenario more packets flow in a network and can result in packet loss.[13] High packet loss cannot confirm delivery of emergency communication over a network, so need precise addressing. In proposed work, minimum packet loss recorded against the basic model of VANET. And also, a basic version of the routing algorithm does not consider prioritization of accidents and critical messages. So, the possibility of road collisions and overheads due to rebroadcasting are more if the emergency message gets delayed or lost.

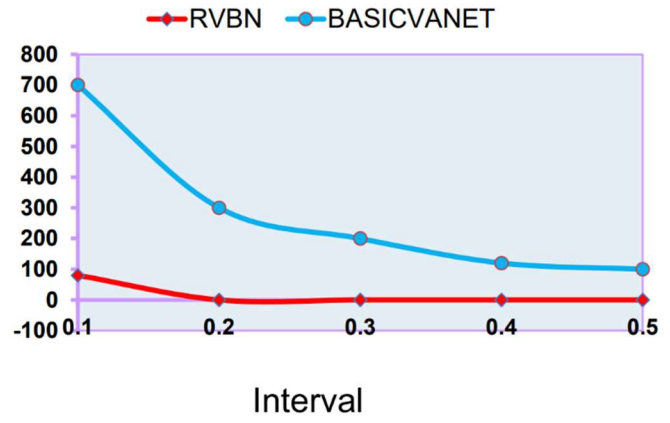

Figure 7: Packet Dropped.

7.3Delay:

The packet delay for default routing of VANET versus proposed accident avoidance RSADP. We observed with

International Journal of Scientific & Engineering Research -IJSER, Volume 11, Issue 9, September 2020
ISSN 2229-5518

low density of on-road vehicles, RSADP obtains improved outputs in contrast with basic VANET. As density increased of on-road vehicles, yet proposed model concerns a minimum delay, reducing the standard delay almost 28% in association with basic VANET.

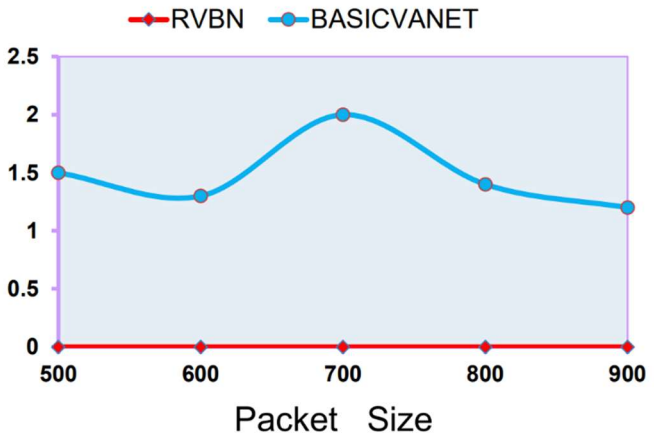

Figure 8: Packet Size Vs Delay.

Minimum average Delay (AD):

$$AD = \frac{\Sigma(Receiving\ Time - Send\ \ time)}{\Sigma(Number\ of\ vehicles)}$$

Within minimum average delay (AD) period, the accident announcements need to be broadcast around the network to avoid road collisions, and avoidance notification needs to be exchanged among vehicles. To obtain the most beneficial feature in VANET with minimum delay.

8. CONCLUSIONS

As vehicular transportation has become an integrated part of our daily routine. Accidents that happen in highways at late night usually do not get a fast response by the ambulance service. One of the challenging parts is to inform about this accident to the authorities (local police unit and ambulance service). To propagate the accident information to the authorities we use VANET along with Roadside units with LTE which will communicate with centralized dedicated infra. In today's world, vehicles are equipped with a variety of sensors on-board (Anti-lock Brakes, Air-bag deployment sensors, accelerometers, gyroscopes). Sensor values evaluation at vehicles OBU can recognize collision. If this process works properly, many lives will be saved because they get medical support within a very short time. In this paper, we have proposed an idea, which is still new, and a lot of work needs to done to make the model perfect.

This model has some limitation, In Bangladesh most of the vehicles are don't have LTE support, that is a reason we have to resort to RSUs. Otherwise, it could have been possible to inform centralized infra directly. For the model proposal, we have ignored the data loss and the severity of the accident. We are planning to do a simulation in the future. In the future, we shall add more parameters to our proposed solution. For example, the severity of an accident, calculating the data loss, along with ambulance take help from philanthropic individuals, etc.

9. ACKNOWLEDGEMENTS

First of all, I remember the Almighty Allah for giving me opportunity and patience to carry on and complete this project work successfully. This work was supported in part by the Department of Information and Communication Technology at Islamic University, Bangladesh.

10. REFERENCES

[1] ur Rehman, S., Khan, M.A., Zia, T.A. and Zheng, L., 2013. Vehicular ad-hoc networks (VANETs)-an overview and challenges. *Journal of Wireless Networking and Communications*, *3*(3), pp.29-38.

[2] Ansari, S., Boutaleb, T., Gamio, C., Sinanovic, S., Krikidis, I. and Sánchez, M., 2016, October. Vehicular safety application identifier algorithm for LTE VANET server. In *2016 8th International Congress on Ultra Modern Telecommunications and Control Systems and Workshops (ICUMT)* (pp. 37-42). IEEE.

[3] Mishra, B., Nayak, P., Behera, S. and Jena, D., 2011, February. Security in vehicular adhoc networks: a survey. In *Proceedings of the 2011 International Conference on Communication, Computing & Security* (pp. 590-595).

[4] Wang, Y. and Ho, K.C., 2015. An asymptotically efficient estimator in closed-form for 3-D AOA localization using a sensor network. *IEEE Transactions on Wireless Communications*, *14*(12), pp.6524-6535.

[5] Weiner, S., 2010. Feasibility of a 802.11 VANET based car accident alert system. *Northeastern University*.

[6] Singh, U.K., Mewada, S., Laddhani, L. and Bunkar, K., 2011. An Overview and Study of Security Issues & Challenges in Mobile Ad hoc Networks (MANET). *International Journal of Computer Science and Information Security*, *9*(4), pp.106-111.

International Journal of Scientific & Engineering Research -IJSER, Volume 11, Issue 9, September 2020
ISSN 2229-5518

[7] Manvi, S.S., Kakkasageri, M.S. and Mahapurush, C.V., 2009, April. Performance analysis of AODV, DSR, and swarm intelligence routing protocols in vehicular ad hoc network environment. In *2009 International Conference on Future Computer and Communication* (pp. 21-25). IEEE.

[8] Fonseca, A. and Vazão, T., 2013. Applicability of position-based routing for VANET in highways and urban environment. *Journal of Network and Computer Applications*, *36*(3), pp.961-973.

[9] Abuelela, M., Olariu, S. and Yan, G., 2008, October. Enhancing automatic incident detection techniques through vehicle to infrastructure communication. In *2008 11th International IEEE Conference on Intelligent Transportation Systems* (pp. 447-452). IEEE.

[10] Krajzewicz, D., Erdmann, J., Behrisch, M. and Bieker, L., 2012. Recent development and applications of SUMO-Simulation of Urban MObility. *International journal on advances in systems and measurements*, *5*(3&4).

[11] Duncan, D.I. and Kreindel, M., 2015. Basic radio frequency: physics and safety and application to aesthetic medicine. In *Radiofrequency in Cosmetic Dermatology* (Vol. 2, pp. 1-22). Karger Publishers.

[12] Aswad, M., Al-Sultan, S. and Zedan, H., 2014, October. Context aware accidents prediction and prevention system for VANET. In *Proceedings of the 3rd International Conference on Context-Aware Systems and Applications* (pp. 162-168).

[13] Choffnes, D.R. and Bustamante, F.E., 2005, September. An integrated mobility and traffic model for vehicular wireless networks. In *Proceedings of the 2nd ACM international workshop on Vehicular ad hoc networks* (pp. 69-78).

AUTHORS PROFILE

Tanjima Hossain, currently pursuing BSc. Degree program in Information and Communication Technology department at Islamic University, Bangladesh. Email: bristy.ice.18@gmail.com.

Khandaker Takdir Ahmed, Assistant Professor, Dept. of Information and Communication Technology, Islamic University, Bangladesh. Email: takdir.iu0607@gmail.com.

Md. Jashim Uddin, Assistant Professor, Dept. of Information and Communication Technology, Islamic University, Bangladesh. Email: jashim.iu@gmail.com.