VANET based Integrated Framework for Traffic Management System: A Progressive Review

Prachi Chaturvedi[1], Abhishek Satyarthi[2]

[1]*Department of computer science and technology , Madhav Institute of technology and science, Madhya Pradesh, India*
[2]*Department of computer science and technology , Madhav Institute of technology and science, Madhya Pradesh, India*

ABSTRACT

Irrefutably the quantity of vehicles on the planet has encountered a noteworthy development, expanding activity thickness which brings about more mischances which explanation behind death in most of the countries. Despite the fact that there is an unfathomable improvement of activity administration framework and car advances, the quantity of mishaps builds every day. In the greater part of the instances of mishaps, absence of giving fast emergency treatment and auspicious restorative administration is the reason for death toll. Thus it is important to build up a typical structure for mishap location, keeping away from auxiliary mischances, auspicious alarm of specialist on call and streamlining the activity for the person on call (emergency vehicle). Along these lines, the scientists, makes and government is moving spotlight towards raising the on street security instead of improving the nature of the streets. The considerable change in the remote advances rose differing new sort of frameworks, for instance, Vehicular Ad Hoc Network (VANET), which gives correspondence between the vehicles and amongst vehicles and street side units. Different propelled ideas, for example, shrewd urban areas and living labs [1] are found in the current years where VANETs assumes a fundamental part. In this paper, an audit on different Intelligent Traffic Systems (ITS) and different V2V and V2I correspondence advances are proposed. In this system, we have likewise proposed a straightforward, solid and productive V2V correspondence innovation to decrease car accidents. It's a canny strong, financially savvy framework which can diminish street mischances and tell same to the driver with the goal that he can make fundamental move before mishaps.

Keyword : *Accident Detection, Traffic Management System, VANETs, Vehicle-to-Vehicle (V2V) communication, Intelligent Traffic System (ITS), Collision avoidance.*

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1. INTRODUCTION

World's road becomes overcrowded and increases road accident due to the increase in the number of vehicles in the globe. Most of the developing countries are the mainly suffering from road accidents due to the lack of proper infrastructure for traffic management and accident management. Among over all road accidents in world highest number of the accidents and loss of lives are happening in India [1]. Also, 90% of the world accident are happening in developing countries.

The accident management system has two major activities

(i) Accident detection & alerting, (ii) Traffic management for emergency vehicles. On mishap identification section a few arrangements were proposed. Some of the major solutions are using mechanical sensors (vibration, acceleration, airbag sensor and so on) and biomedical sensors (heart rate, pressure, temperature sensors and so on).

Both these solutions has its own advantage and disadvantages. Using mechanical sensors is easy to use, but we can't get the exact picture of the accident. It can detect only accident not important attributes like whether the accident is large scale or small, does passenger needs medical help or not and so on. In case of medical sensor there may be the high possibility of generating false alarms. In traffic management for emergency vehicle centralized or distributed approaches were proposed. Traffic control varies from simple priority based traffic control of traffic signals to

VANET based alert flooding schemes that include complex congestion detection algorithms. Several algorithms like optimized Dijkstra and A* algorithms were used for finding shortest paths. Apart from these drawbacks of individual approaches, major drawbacks in all the existing system is that all the works concentrate on only any one of the two major tasks (accident detection & alerting and traffic management). This creates major integration problem when these approaches were considered for implementation in real time. In our approach we provide a reliable framework where both detection & alarming and traffic management are integrated by means of IoT network. In order to increase accuracy of the alarming hybrid approach of both biometric and mechanical sensors are used. We propose VANET based Dijkstra algorithm for finding optimal paths for medical vehicle. IoT is the emerging technology that has huge impact on society and day to day activities. It is the network of millions of things (things may be anything from humans, vehicles to even small pen) [2]. With IoT, sensors are pervasively installed in our condition that gathers data about the things and they impart this data to each other to make a big picture about the environment. With the help of IoT, we create a network among vehicles, ambulances and hospitals.

VANET is used for creating a network with vehicles that can interact with other vehicles and roadside units. For establishing communication in our vehicular network, we use IEEE 802.11p (WAVE) protocol [3]. WAVE is a standard protocol for Dedicated Short range communication. It is developed from existing IEEE 802.11 for supporting vehicular communication. WAVE underpins both direct vehicle to vehicle (v2v) and vehicle to roadside unit (V2I) correspondence. In our approach we use WAVE protocol to exchange vehicular status information with Road Side Units and for communication between the vehicles.

2. LITERATURE SURVEY

In the current past, researchers have examined a big selection of technologies in an try to discover advanced techniques of tracking traffic situations. This research in site visitors surveillance has ranged from studies of traditional loop detection techniques to using anti-submarine conflict technology. H. A short survey of technologies explored at some stage in the beyond decade and a half of is given under to offer an understanding of the level of studies interest in site visitors surveillance technologies.

Bohnke and P fanner still [4][5] acknowledged a need for extra reliable visitors facts acquisition than localized facts collection generated by way of traditional loop detectors (1986). The pair added a pattern popularity algorithm which could make use of particular automobile presence signatures generated by successive collection of inductance loop detectors. By identifying and reidentifying platoons of motors journeying across hyperlinks bounded by loop detection gadget, car journey times might be received.

Ju and Maze completed reproductions on occurrence recognition systems utilizing the FREQ8PE recreation rendition (1989). Their research evaluated a contrast of incident detection strategies the use of police patrol versus the use of motorist call packing containers at 1 km spacing. The motorist name packing containers formed the backbone of the modeled parkway surveillance and manipulate system (FSCS). This FSCS yielded a gain-to-value ratio of 2.69 as it generated benefits from tour-time reduction and reduced gas intake. These benefits had been added approximately via reduced incident detection time afforded via the motorist name bins.

AT&T [6] experimented with the usage of applied acoustic and digital sign processing era to provide a vehicular site visitors surveillance machine (Nordwall, 1994). Marked the SmartSonic Traffic Surveillance System (SmartSonic TSS-1), the venture was planned by utilizing AT&T to refresh covered attractive loop9 discovery frameworks. This technology become at the beginning developed from studies utilized by the U.S. Navy for

submarine detection functions. Mounted above passing automobiles, the SmartSonic [7] TSS-1 listens to the acoustic signals of vehicles and is able to distinguishing between large trucks or buses and smaller motors. Applications have been to include visitors tracking and automobile counting, with the capacity for incident detection being an area for in addition research. In their dialogue of video-based surveillance,

Berka and Lall maintain the dialogue of improving upon using loop detection to collect traffic records (1998). The authors claim that loop detection reliability is low, and that renovation and repair of one of these pavement-based totally system creates safety dangers for repair crews. Berka and Lall hold that non-intrusive technology which include video surveillance offer decreased traffic disruption in the course of installation or repair. In addition, video surveillance is able to detecting incidents on the perimeters of roadways, outside of the detection range of loop detectors.

3. RELATED WORK

A. Accident detection and alerting

This area of the accident management is well studied and several approaches are proposed for accident detection alerting. In Prabakar et al. Biometric sensors like temperature, heart rate sensors are used to detect the accident. It also contains an accelerometer and an air bag sensor for preventing false alarm. It also contains a separate coma identification module. GSM and GPS are used for alerting and positioning accident vehicle to emergency responder. In Brian et al. Smartphones that run on android/iOS platform can be used to detect accident using the accelerometer, microphone and gyroscope in smartphones. This approach uses the GPS to locate the position and VoIP to generate alerts [9]. Since smartphones can be dropped and in such event false alarming may triggered. Vehicular sensor based approach is proposed by Fekri M. Abduljalil. In which vehicular sensors like airbag sensors, accelerometer, angle sensor to detect accidents and use next generation integrated IP network to propagate the alert [10].

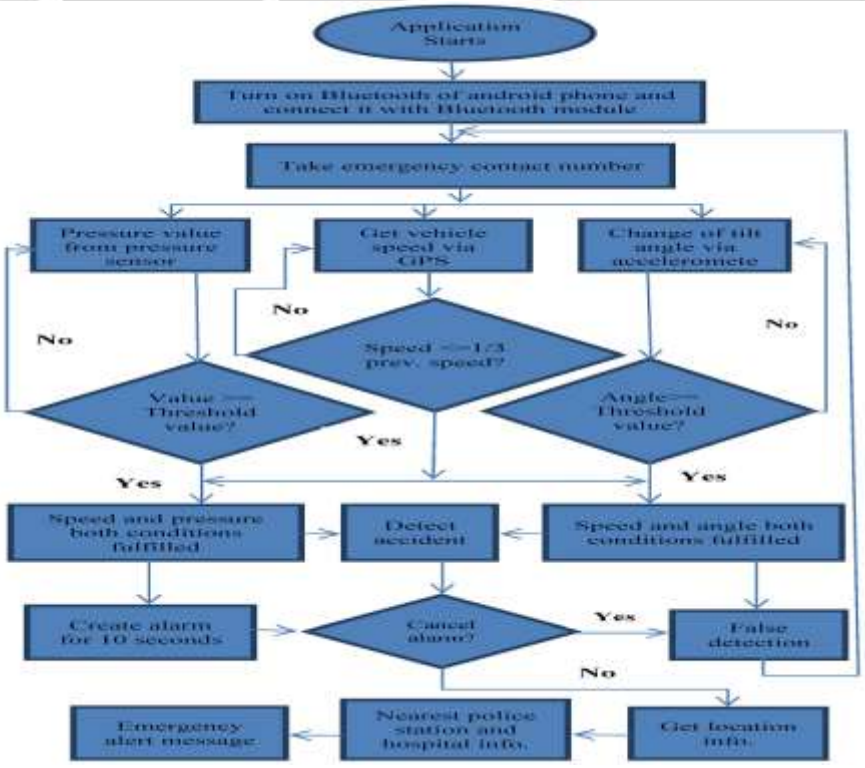

Fig. 1. System architecture

B. Activity arranging

In Smitha et al. GPS based course arranging with the assistance of Dijkstra calculation are proposed. The principle lake in the approach is its absence of capacity to arrange a course progressively [11].

Ing-Chu et al. Propose a dynamic course arranging approach in view of VANET utilizing A* calculation. In any case, this approach was principally created for typical vehicles and works in disseminated way because of the huge number of roadside vehicle [12]. Receiving this way to deal with restricted numbered rescue vehicle arrange makes a few difficulties.

In Miao et al. approach they locate the ideal way utilizing the Stochastic Lyapunov advancement procedure. A large portion of the way panning approach so far created are implied for ordinary vehicles [13]. We can't execute those methodologies straightforwardly from rescue vehicle condition because of its need prerequisites and a moderately modest number when contrasted with roadside vehicles. Just not very many papers just concentration exceptionally for crisis vehicle.

Amnesh et al. propose an approach for organizing activity light with the assistance of remote sensors and it additionally make utilization of sound power of the crisis vehicle to recognize remove also, heading of the crisis vehicles [14].

Minghe et al. propose a RFID and IoT based vehicular distinguishing proof and information gathering framework for movement observing and control [15].

George et al. give a model to spreading the neighborhood mishap cautioning informing to maintain a strategic distance from auxiliary mischances [16].

The primary target of vehicle correspondence is to decrease the potential driving danger, enhance drivers' wellbeing file and furthermore go about as reciprocal of mankind's reaction interim in a mishap. Thus, it has extraordinary impact on traveler wellbeing and for drivers to easily driving in urban range. Numerous nations bolster this innovation inquiries about. There are numerous open assets ventures actualized in Europe in the previous decades. The undertakings cover a few perspectives; one side is the between vehicle correspondence and system frameworks which partner driver for security and identifying of the key segments status, when sub-framework exist issues then cautioning framework can pre-alarm through between vehicle correspondence organize. Fleet Net (web out and about) venture financed by Germany government which took a gander at various base radio frameworks that could be utilized to execute vehicle correspondence, among these UTRATDD (innovation intended for the unpaired UMTS groups), information transmission in view of IEEE 802.11 Wireless LAN frameworks and 24 GHz radar [17]. Really it is correspondence innovation application between vehicles, when the running vehicle meets a crisis circumstance before it, the framework can recognize conditions in the meantime criticism ready message to the driver through the vehicle to vehicle correspondence for wellbeing pre-alarm. Besides, vehicle correspondence examine additionally ventures into new stage in US, Asia nations, for example, China, Japan and Korea. These nations built up numerous open reserve bolster ventures which ceaseless concentrate on vehicle correspondence and advancement of the innovation. There are a few continuous inquiries about identified with this territory, the agent one is PATH extend which is mean to enhance the keen of transport frameworks [18].

SafeTrip-21 start is another venture supported by U.S. branch of transportation [19,20]. It is a piece of the intelliDrive program in which a consortium of carmaker behaviors shows and operational tests to accelerate the advancement of vehicle correspondence innovations that improve transportation security and versatility highlights. China government built up a progression of arrangements which unique concentrate on wise transportation framework assembles; a few trial ranges has been placed into practice in Shanghai, Tianjin and Chongqing [21].

A review of a few Intelligent Traffic Systems (ITS) and different steering conventions is portrayed in [22]. It likewise presents another plan made out of a shrewd city structure that transmits data about activity conditions that will help the driver to take fitting choices. It incorporates a notice message module made out of Intelligent Traffic Lights (ITLs) which offers data to the driver about ebb and flow movement conditions. In [23], a propelled correspondence innovation is helped by wise Artificial Neural Network (ANN) framework and fluffy framework keeping in mind the end goal to mine the specific components of educational accumulations. Thus it doles out precise notice and seriousness estimation of the mischance for better help with auto collisions .This framework diminish the reaction time to give caution about mishap and henceforth will enhance the general safeguard prepare after a mischance happens. It's a canny vigorous, financially savvy framework which can recognize street mishaps, inform them, and gauge their seriousness. The work in [24] is an overview about multifunctional information driven clever transportation framework, which assembles a lot of information from various assets: Vision-Driven ITS (information amassed from video sensors and utilized acknowledgment comprehensive of vehicle and person on foot recognition); Multisource Driven ITS (e.g. laser radar, inductive-circle finders, GPS and so forth.); Learning-Driven ITS (productive forecast of the event of mishaps to improve the wellbeing of walkers by diminishing the impact of vehicle accident);and Visualization-Driven ITS (to help leaders quickly distinguish unusual activity designs and in like manner take powerful measures). In any case, it needs vast measure of memory to stores the recordings [25]. To limit the negative impact on the soundness of the tenant, save administrations and restorative help ought to give quickly after mishap. Manuel Fogue et .al. [26] planned an e-Notify framework for programmed identification, announcing and help of street car crashes which helps in diminishing the time expected to convey the crisis benefits after a mischances happens. The vehicles in this framework includes different sensors, would be utilized to decide the present status of the vehicle. The on board unit prepared inside the vehicle is in charge of recognizing the mischance then advise this data to an outside control unit which appraises the seriousness of the mishaps subsequently can assign essential assets for its aids. This e-NOTIFY framework consolidates both V2V and V2I correspondences. Between vehicular correspondence is displayed in view of a versatile movement flag control framework [26]. This framework lessens the holding up time of the vehicles at the square likewise brings about decrease in holding up time at the flag. To understand this framework, the idea of bunching is utilized to assemble the information of the vehicles coming towards the convergence. Framework that takes the control choices depended on the data originating from the vehicles is exceptionally all around portrayed by the creators [27]. Each vehicle is furnished with a short range specialized gadget and controller hubs are set in the crossing point with activity lights. This controller hub at convergence speaks to as versatile control flag framework. The creator in [28] accentuates some key focuses favoring the utilization of an infrastructural engineering with full Road Side Unit (RSU) scope, shows a survey of the utilized time-opened arranged MAC approach depended on the Wireless Access in Vehicular Environment (WAVE) standard, demonstrates the issue of RSUs' coordination utilizing reference focuses, and discusses the vehicle space elective for the fundamental impart of prosperity essential messages, to guarantee that they are propitious passed on. In [29], creator gives a short review of approaches to improve the execution of security message conveyance in VANET. It clarifies about Ve-MAC convention for good communicate of wellbeing message and cross breed correspondence plan to approve availability under meager movement and thick activity conditions. The paper additionally concentrates the impact of concealed terminal issue in VANET. In [30], creators give a diagnostic overview of existing issues in video-based observation frameworks for the vehicle and demonstrate a general design for video assessment frameworks, i.e., the various leveled and organized vehicle investigation, to watch the distinctive existing and potential strategies. Creators likewise looked into and examined the distinctive techniques as for every module. Applications what's more, future advance are examined to give future needs of ITS administrations. In [31] , creator builds up an optical vehicle-to vehicle (V2V) correspondence framework rely on upon an optical remote correspondence innovation by utilizing a LED transmitter and a camera recipient, which delegates an uncommon CMOS picture sensor, for example, an optical correspondence picture sensor (OCI). Because of the LED location strategy utilizing the banner picture, the camera beneficiary absolutely distinguishes LEDs, progressively and in testing outside conditions. Between two vehicles, different vehicle inward information (like speed), picture information (320 _ 240, shading) are transmitted prosperously, and the 13.0-fps picture information gathering is achieved while driving outside.

A few specialists have tended to the point of unmanned vehicles, especially managing novel directing methods. Crash expectation can be accomplished by means of evaluating the direction of articles, while impact shirking is accomplished through controlling the speed of the vehicle or through replanning the way of the vehicle [32]. In [19] Xu et al. propose a self-sufficient constant driving movement organizer with direction advancement, in view of an arrangement of cost capacities. In [33], Krogh and Thorpe display a technique for vehicle direction that depends on way unwinding to figure basic focuses utilizing from the earlier data and sensor information along an attractive way. The extent of this technique is to give a crash free way to the vehicle.

4. ITS TECHNOLOGY AND APPLICATIONS

4.1. Advancements utilized as a part of ITS

The territory of ITS is bolstered by three advances: Data accumulation advances, correspondence innovations and regular database framework. Additionally propel methods are likewise incorporated into ITS which are examined in writing audit. The depiction of essential advances is given:

• Data gathering advances: The prime prerequisite of ITS is precise and far reaching information. As of late unmistakable strategies have been proposed and executed for the change of information gathering techniques. The information accumulation innovations are chiefly partitioned into two classifications: foundation based innovation (Inductive circles, sensors, CCTVs) and vehicle-based innovation (GPS, cell based and skimming auto advancements).

• Communication advances: There are various correspondence innovations that are accessible to be utilized as a part of ITS. The techniques contrast concerning limit, cost and working procedure. These advances differ from phone lines to propel innovation, for example, General Packet Radio Service (GPRS) lastly different Adhoc remote correspondence and remote broadband advances. Vehicular Ad hoc NETWORK (VANETs) have turned out to be prevalent in remote interchanges for insightful bury vehicle correspondence [4,5].

• Database administration: ITS additionally makes utilization of databases for dealing with the data identified with activity and additionally to get a diagram of the system in light of data got.

4.2 ITS Applications The different ITS applications are depicted as takes after:

• Traffic Control: It concentrates for the most part on organizing the methods of transport, for example, transports, cyclist, people on foot and other crisis vehicles with a specific end goal to assess the execution and study the purposes behind activity emanations and clog.

• Disaster administration frameworks: Various advancements are utilized for this reason keeping in mind the end goal to smooth the activity stream and to give therapeutic what's more, other related help in such cases.

• Vehicle data and route frameworks: In-vehicle data framework cautions drivers about unfriendly atmosphere conditions, street surface conditions, car influxes and risks including mischances. Route frameworks give vehicle area data continuously and course direction for driver to take ideal course.

• Driver help frameworks: keeping in mind the end goal to spare the driver from mischances these frameworks have supplanted some human driver choices with machine choices which additionally help to accomplish smoother vehicle control.

• Air contamination control: Road transport is the real wellspring of air contamination which has brought about effect on human wellbeing and condition quality. Different models and conventions are utilized as a part of ITS to control air contamination [6, 7].

Table 1: Summary of various transport issues covered in literature survey

Sl. No.	Ref. No.	Transport Related Issues						
		Traffic Control	Air Pollu-tion	Crime control	Efficient navi-gation	Conge-stion control	Resource manage-ment	Disaster Manage-ment
1	.8	×						
2	6		×					
3	9	×						×
4	10	×						
5	11			×				
6	4							×
7	5	×						
8	12				×			
9	13							×
10	14	×				×		
11	15	×	×			×		
12	16	×	×		×		×	
13	17					×		
14	18					×		
15	19							×
16	7		×					
17	3	×					×	
18	21	×				×		
19	22				×			
20	23							×
21	24					×		
22	25						×	
23	26				×			
24	27					×		×

Table 2. Summary of techniques and technologies used to solve transport related issues

Sl. No.	Author's Name	Techniques and Technologies						
		Sensors	Agent based computing	Vehicular cloud computing	VANET/ VSS	RFID readers	Advance GPS	Smart traffic lights
1	8	×						
2	9	×						
3	10		×					
4	11	×						
5	4			×	×			
6	5				×			×
7	12						×	

5. OVERVIEW OF FUTURE TRAFFIC MANAGEMENT SYSTEMS

A Traffic Management (TMS) gives abilities that may potentially be used to lessen street site visitors congestion, improve response time to incidents, and make certain a better tour revel in for commuters. A typical TMS consists of a hard and fast of complementary stages, as shown in Figure 1, every of which plays a particular position in ensuring green monitoring and control of the traffic glide within the city. The cornerstone section of a TMS is Data Sensing and Gathering (DSG) wherein heterogeneous street tracking gadget degree traffic parameters (which include visitors volumes, pace and road segments occupancy, and many others.), and periodically file these readings to a imperative entity. For instance, those monitoring tools can hit upon random incidents and without delay report them thru wireless networks, mobile networks or cell sensing programs. Subsequently, those information feeds are fused and aggregated in the course of the Data Fusion, Processing and Aggregation (DFPA) phase to extract useful visitors facts. The next segment, Data Exploitation (DE), uses this acquired expertise from the processed statistics to compute: highest quality routes for the cars, brief term site visitors forecasts, and diverse different avenue visitors statistics.

Finally within the Service Delivery (SD) segment, the TMS grants this expertise to the cease customers (consisting of drivers, authorities, non-public businesses, and so on.) the use of an expansion of devices along with smart telephones, cars' on-board gadgets, and so on. The capabilities offered by means of a TMS are not constrained to serve drivers and street authorities handiest,

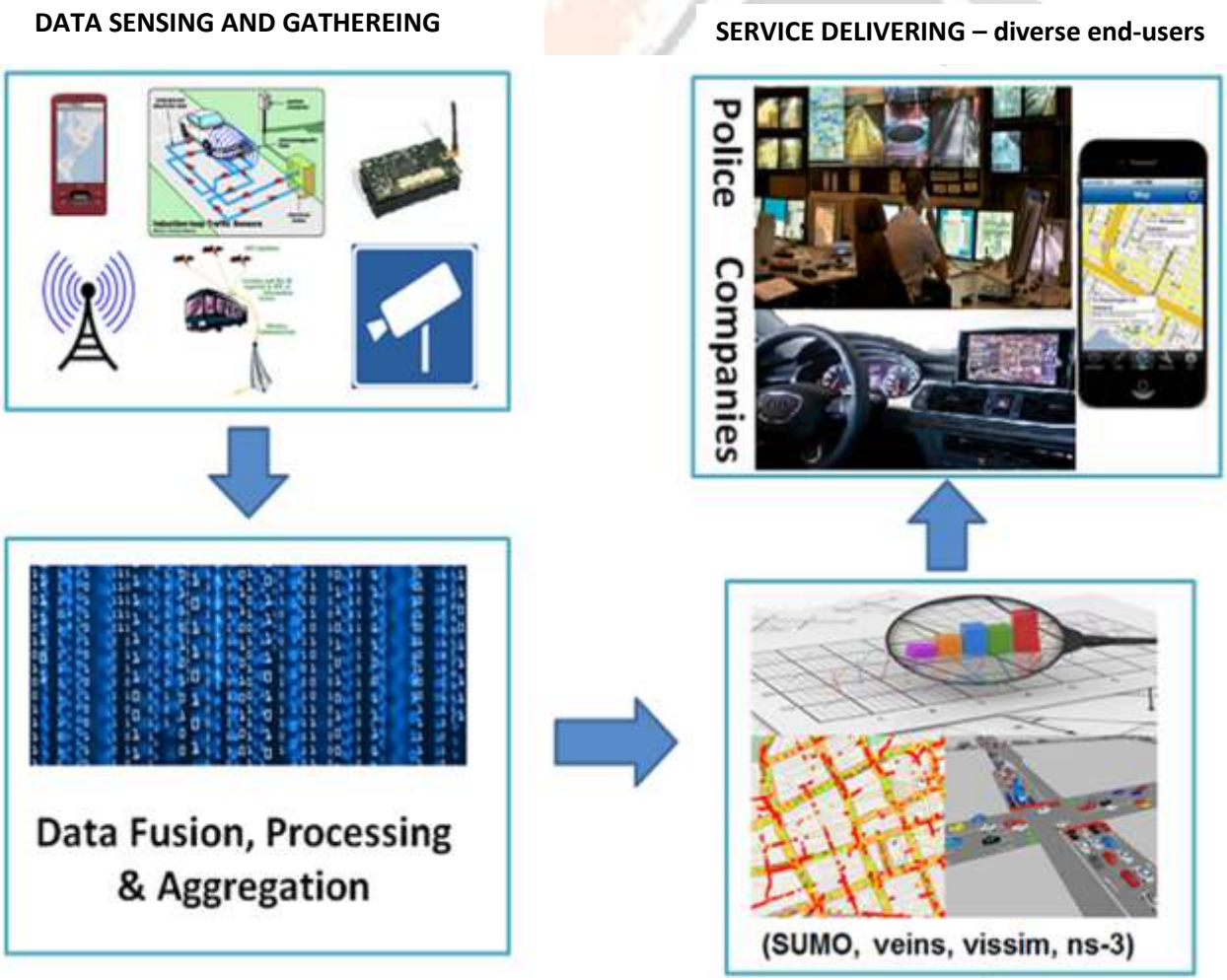

FIGURE 1: DATA LIFE CYCLE IN SMART TRANSPORTATION

but also can contribute extensively to the monetary increase of a rustic, to the protection of citizens' protection and to the help of national security. The presently deployed technology for street traffic surveillance nevertheless be afflicted by a loss of visitors parameters dimension accuracy and actual-time record of events that arise on the roads, in particular in growing countries. Moreover, the accrued visitors statistics normally wishes to undergo a filtering process to enhance its nice and put off the noise. Deploying distinctly state-of-the-art device to ensure accurate estimation of site visitors flows and well timed detection of emergency activities might not be the perfect answer, because of the quandary in monetary assets to assist dense however also can make a contribution significantly to the monetary increase of a rustic, to the renovation of residents' safety and to the support of national security. Therefore, opportunity price-powerful and bendy answers are needed to guarantee better control of road traffic in both advanced and developing countries. A cutting-edge TMS objectives to conquer some of the above limitations through designing revolutionary strategies capable of take advantage of advanced technologies to correctly reveal the evolving vital street infrastructure.

These strategies should be scalable enough so as to allow better manipulate of the traffic glide and greater control of big cities' avenue networks. This will honestly improve the accuracy of the received actual-time site visitors records and the short-term visitors prediction. This will enable making and the use of quick-time period predictions based totally on modern-day visitors volumes to pick out bottlenecks and make extra informed choices about the way to high-quality reroute visitors, alternate lane priorities, modify visitors light sequences, and many others.

A present day TMS ought to likewise give a visual instrument that can show continuously activity data identified with area of bottlenecks, occurrences, and clog level in each road segment, as well as estimated travel time from one location to another in the road network. In this way, the transport authorities will have an overall view of the road network in real-time, and will enable the best support for improvements in the traffic flow management and more efficient reactions to emergency incidents on the roads. An adequate TMS for future smart cities should fulfill the following requirements:

• Ensure higher accuracy in estimating traffic conditions and better efficiency in dealing with emergency situations on the roads, compared to the existing TMSs.

• Be able to efficiently manage the traffic in road networks of varying size and characteristics.

• Provide real-time road traffic simulation and visualization to help authorities more efficiently manage the road infrastructure and improve route planning for commuters.

• Ensure simplified and smooth integration of existing systems and new technologies, and manage the evolution of these systems

Figure 2. Traffic Scenario showing vehicles on one lane with the other three lanes as empty.

An abnormal state compositional review of an advanced TMS is delineated in Figure 2. This figure shows the main components of the TMS needed to deliver the collected road traffic information to the intended end consumers (e.g. road authorities, Police, drivers etc). As we can see from this figure, the core system of the TMS collects road traffic information from heterogeneous data sources according to the consumer needs and specific requests. These data feeds are then aggregated and stored in an unified format in one or multiple databases. Later, upon reception of a consumer request, the core system processes the request and extracts the pertinent data from the appropriate database. Then the requested information is sent back to the intended consumer, tailored for their specific purposes: e.g. analysis and statistics, decision-making, etc.

6. CONCLUSION

Highway obstacle identification is one of the most challenging tasks in real time for autonomous vehicle navigation system. In this paper, the different vehicular communication techniques are reviewed and on this basis, we are intended to propose a fully equipped, intelligent vehicle system which will not only be useful for collision avoidance but also for the wireless communication between two vehicles for information exchange. This vehicle will be able to communicate with the other vehicles wirelessly by using Xbee.

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