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CLUSTER BASED COLLISION AVOIDANCE MODEL ON HIGHWAY VEHICLES FOR DISASTER MANAGEMENT USING WIRELESS SENSOR NETWORKS

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ABSTRACT

Now days, there are number of domains and application areas which are growing very rapidly. With this swift speed of the growth, there are more probabilities of disasters especially in case of automobile sector as millions of vehicles are running on the highway. Such global diversion is escalating the occurrence of extreme climate phenomenon with increasing severity, both in terms of human casualty as well as financial losses. An effective disaster detection and alerting system can reduce the damage of life as well as the assets. It is important to create a unique model or structure to sense environmental data to detect hazards. Such architecture needs to be independent, easy deployed and adapted to different situations. This paper presents and proposes an effective model and mechanism for processing wireless sensor networks to detect dangers in disaster situations. In this manuscript, the technological solutions for managing disaster using wireless sensor networks using disaster detection and alerting system is proposed. In the proposed approach, the disaster management can be implemented in vehicles running on the highway. Using this approach, the accidents on the highway can be reduced by measuring the minimum distance between the vehicles

Keywords - Disaster Management, Wireless Sensor Networks

INTRODUCTION

A Wireless Sensor Network or simply WSN of spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network

to a main location. The network is having number of nodes that can range from a few to several hundreds or even thousands, where each node is connected to one or multiple sensors. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. [1] The topology of such networks can vary from a simple star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding. [2]

DISASTER MANAGEMENT ASPECTS

Disaster management or emergency response is a key discipline for providing necessary responses whenever and wherever a catastrophe occurs to save lives and reduce casualties. From an engineering approach, machineries can be designed and used to help with detection or prediction of the disastrous events. One of the recent technologies enabling (near) real-time detection of such events is the wireless sensor networks. Wireless sensor networks typically consist of a large number of small, low-cost sensor nodes distributed over a large area. The sensor nodes are integrated with sensing, processing and wireless communication capabilities. Each node is usually equipped with a wireless radio transceiver, a small microcontroller, a power source, and multi-type sensors (e.g. temperature, humidity, smoke). These components enable a sensor node to sense the environment, communicate and exchange sensory data with other nodes in the area, locally process its own data and make smart decisions about what it observes. This will lead to detection of events and unusual data behaviours whenever and wherever they occur. This feature is called event detection. Event detection functionality of WSNs has attracted much attention in variety of applications such as industrial safety and security, meteorological hazards, and fire detection [1]. Resource constraints of the wireless sensor nodes, dynamicity of the deployment area [2], and unreliability of wireless communication introduce unique design challenges.

LITERATURE REVIEW

Harminder Kaur et. al. (2012) [3] – In this research manuscript, the major aim is to review the technological solutions for managing disaster using wireless sensor networks (WSN) via disaster detection and alerting system, and search and rescue operations. This work first discussed the basic architecture of WSNs that can be helpful in disaster management and the wireless sensor network models that can be employed for the different disaster situations. Finally, the authors propose how these networks can be effective in Indian scenario which lags behind the developed world in basic infrastructure amenities. Wireless sensor networks (WSNs) have attracted significant attention over the past few years.

Bahrepour et. al. (2013) [4] - In this research paper, the authors introduce machine learning techniques for distributed event detection in WSNs and evaluate their performance and applicability for early detection of disasters, specifically residential fires. To this end, the work present a distributed event detection approach incorporating a novel

reputation-based voting and the decision tree and evaluate its performance in terms of detection accuracy and time complexity.

Aziz (2011) [5] - In this paper, the authors has proposed and analyzed the unique algorithmic approaches and techniques for the disaster management in multiple domains. The authors have critically analyzed various factors and remedies that can be used for removing any situation that can lead to any disastrous condition. Using the wireless sensor networks, the authors has proposed number of methods that can be used using the wireless sensor networks for avoidance of the disasters. Global climate change is increasing the occurrence of extreme climate phenomenon with increasing severity, both in terms of human casualty as well as economic losses. Authorities need to be better equipped to face these global truths.

Akkaya (2005) [6] - In this manuscript the authors has extracted number of domains and areas where the wireless sensor network can be used for the disaster management using different algorithms and protocols. The example as well as the case study of landsliding is explained that makes use of the wireless sensor networks in the avoidance and future predictions. Additionally, the authors has underlined air pollution monitoring as well as emergency response using wireless technology. The applications as well as remedial measures are very exceptionally explained by the authors of the paper.

Marco Zennaro (2012) [7] - In this presentation and manuscript, the authors related the paradigm of wireless sensor network with disaster management. Using different architectures and diagrammatic approaches, the protocols and algorithms has been explained in multiple domains. Using low power 802.11 technology, the disasters and emergency situations can be very easily operated with the use of specific devices and paradigms.

Bahrepour et. al. (2010) [8] – This work explains that the wireless sensor networks (WSNs) have become mature enough to go beyond being simple fine-grained continuous monitoring platforms and become one of the enabling technologies for disaster early-warning systems. Event detection functionality of WSNs can be of great help and importance for (near) real-time detection of, for example, meteorological natural hazards and wild and residential fires.

OmidBushehrian et. al. (2010) [9] - told that With the faster adoption of wireless sensor networks (WSNs),on the one hand sensor - derived data need to be accessed via various Web - based social networks or virtual communities and on the other hand, limited processing ability of WSNs is a hurdle. To address this issue WSNs can be integrated with cloud . Cloud enjoys ample processing ability andis a capable infrastructure to deliver people - centric and context - aware services to users, thus expedites adoption of WSNs.In this paper a novel framework based on policy based network management is proposed to integrate WSNs with cloud , aims to automate and simplifies WSN's management tasks.

Chia-Fen Hsieh et. al. (2014) [10] This is an open access article distributed under the Creative Commons Attribution License, which permits

 Abstract With the increasing application of wireless sensor networks (WSN), the security requirements for wireless sensor network communications have become critical. However, the detection mechanisms of such systems impact the effectiveness of the entire network. In this paper, we propose a lightweight ontology-based wireless intrusion detection system (OWIDS). The system applies an ontology to a patrol intrusion detection system (PIDS). A PIDS is used to detect anomalies via detection knowledge. The system constructs the relationship of the sensor nodes in an ontology to enhance PIDS robustness. The sensor nodes preload comparison methods without detection knowledge. The system transfers a portion of the detection knowledge to detect anomalies. The memory requirement of a PIDS is lower than that of other methods which preload entire IDS. Finally, the isolation tables prevent repeated detection of an anomaly. The system adjusts detection knowledge until it converges. The experimental results show that OWIDS can reduce IDS (intrusion detection system) energy consumption.

Gadallah (2011) [11] - Mobile ad hoc networks (MANET) can be used quite effectively to manage resource allocation in operations such as search and rescue, military combat, and firefighting. In the event that an operations area, e.g. in case of disaster rescue operations, is large, the use of Wireless Sensor Networks (WSNs) can be crucial in locating the spots of highest need of rescue resources. We can adapt the techniques of service discovery in MANET for use in the process of searching for and allocating the most proper rescue resource for encountered emergency situations and needs.

XG Sun (2011) [12] - The post-disaster road monitoring system provides an interesting application area for wireless sensor networks. After the earthquake, roads are subject to be blocked by landslides. The people require a scalable and low-cost technology for getting real-time dynamic data about road availability because aftershocks occur continuously. Wireless sensor networks are a promising candidate to fulfil these requirements. In this paper the post-disaster road monitoring system solution is put forward. Sensors selection and node configurations, node deployment, multi-sensor information integrated algorithm, and image collection mode are discussed. The multi-sensor information integrated algorithm is adopted to judge the event. And the node deployment is calculated by sensor coverage radius and expectations and redundancy of the system.

J Wang - 2008 [13] - A scheme based on wireless sensor networks (WSN) which combined with mobile communications technology using in mines emergence communications was researched. Any safety parameters of coal mines - such as gas concentration and co concentration - were obtained by WSN systems in emergency or coal disaster, and then data were collected and transmitted to data processing center with mobile communication modules, the information were also sent to managers at the same time.

SYSTEM MODEL

In the proposed model, the dynamic cluster formation is implemented on the highway vehicles

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so that the minimum distance is maintained and any point of disaster or accident should not happen.

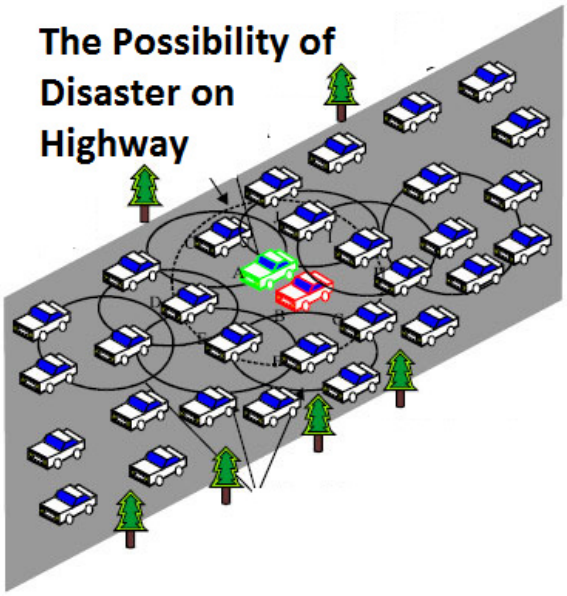

Figure 1 - Problem Identification Scenario on Highway

In Figure 1, it is visible that the minimum distance is not maintained in the vehicles and there is no centralized server or base station which can control and direct the vehicles.

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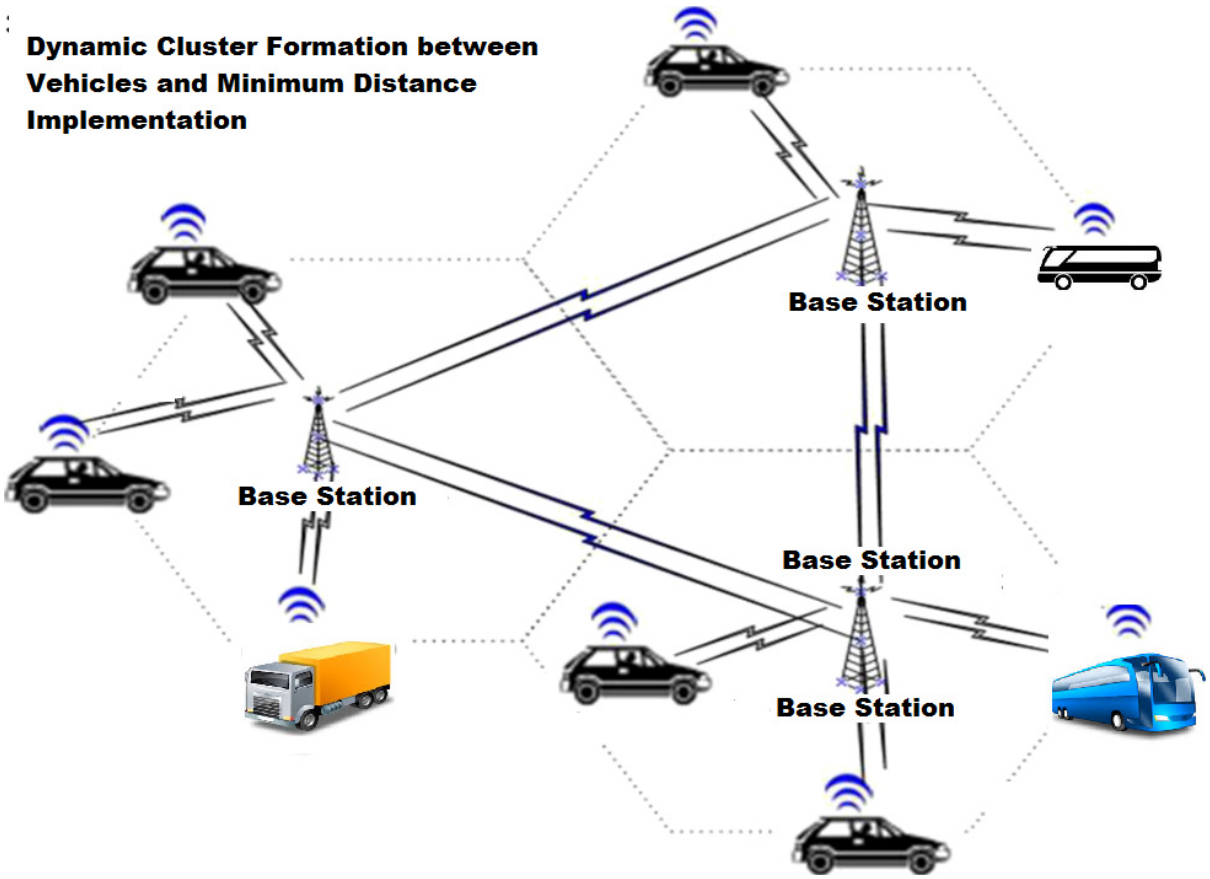

Figure 2 - Proposed Model for Avoidance of Accidents using Minimum Distance on Highway

In Figure 2, it is evident that the minimum distance between the vehicles is maintained with the continuous communication with the base station. Using this approach, the circumstances of any disaster is completely avoided.

IMPLEMENTATION

- Deployment of the Sensor Nodes and Formation of Wireless Sensor Network on the Highway.
- WSN Node / Chip Based direct communication with the base station is integrated.
- The base station shall keep track of every vehicle and their activities in terms of speed and direction
- If any obstacle comes, the sensor network shall form a cluster and transmit data to base station. The minimum distance threshold is implemented so that there is no collision.
- Signal will be transmitted to the vehicle from the base station to change or update the speed as well as direction.
- Overall performance and lifetime of the network will improve

PROPOSED ALGORITHM

1. Activation of the Highway Track H with a specific region or area of deployment

2. Set of WSN_i={i<=n) Max. N Nodes

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3. Assign the Specific Th Threshold for the Distance Vector. Th Threshold shall be used to maintain the minimum distance between the vehicles to avoid any collision.

4. Deployment of the network scenario.

5. Activation of the WSN_i with Cluster CH_j

6. Investigate and Calculate the Vector of Hindrance or Obstacle

7. Activate BS_i. BS shall keep track of the movements (Speed and Direction) of every vehicle

8. Regularly Monitor the Dist of CH to OB

9. If (dist (V_i, V_j) >Th)

Sig[i]=BS[i]

(V_i, V_j -> Vehicles)

10. Report Ri to BS and Satellite (S)

11. Comparative Analysis and Report Generation with Final Vector Generation

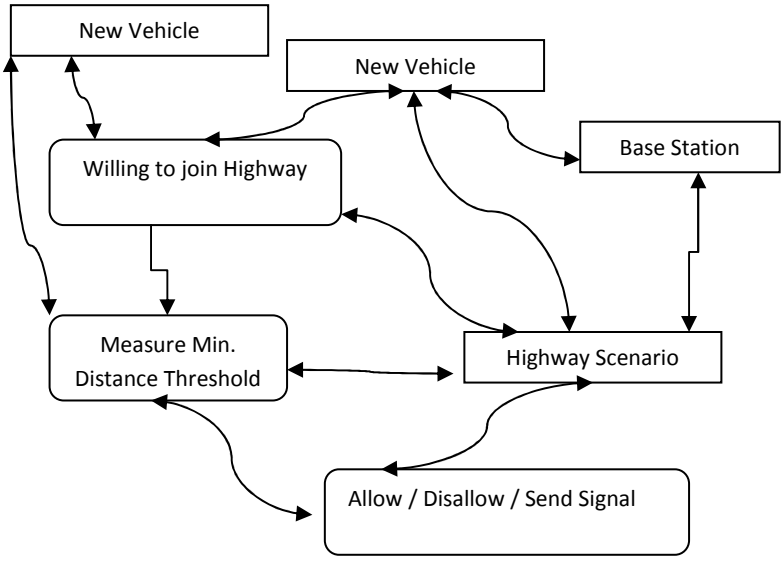

Figure 3 - DFD of the Proposed Approach

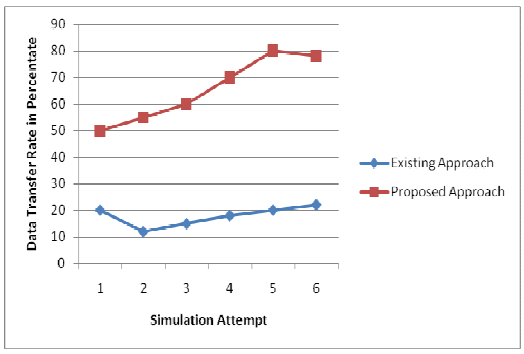

Figure 3 - Comparison between Existing and Proposed in terms of Data Transfer

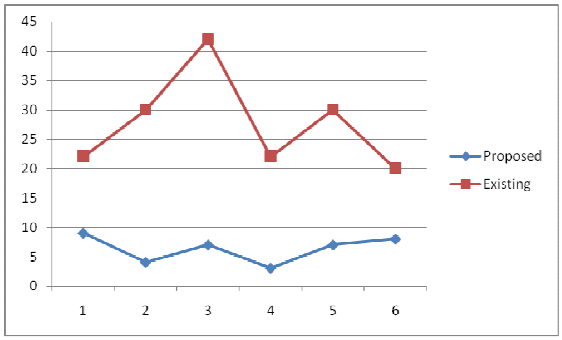

Figure 4 - Comparison between Existing and Proposed in terms of Packet Loss

CONCLUSION

Wireless Sensor Networks are implemented in assorted domains for multiple applications. Now days, WSN implementation is done widely for disaster management for avoidance of human as well as asset loss. In this manuscript, a novel algorithmic approach and model is proposed for the avoidance of collision on the highway. Using the proposed model, the minimum distance as well as the speed factor is continuously monitored by the base station and appropriate signal is transmitted for prevention of any crash.

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