

REVIEW ON SAFETY IN HILLY REGIONS

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Abstract— The residents of the hilly regions have to face many problems because of the increasing traffic and resulting congestion and also due to the calamities like landslides, floods etc. which disrupt the traffic flow. The hilly regions are more prone to the destruction due to the above mentioned reasons and have to suffer a huge loss of life and property. These places being tourist attractions also are flooded with tourists in the peak season. It becomes extra difficult for the tourists to cope up with the roads in the hilly areas as they are unaware about the accidental curves, sharp turns, bridge breaks etc. and hence there are high chances that they may meet with an accident. Any landslide or flood during the peak tourist time leads to a greater loss of life. A lot of research is being carried out with respect to minimizing these hazardous incidents and their destruction. Wireless Sensor Network combined with Internet of Things seems to be a popular choice in this regard. This paper discusses some techniques used to track these unwanted happenings and thereby reduce or prevent the resulting loss.

Keywords— Wireless Sensor Network, Internet of Things, Road Safety, Hilly Areas

1. INTRODUCTION

In recent times, there has been a considerable increase in the traffic in the hilly regions. This brisk increase of automobile traffic results in congestion and disrupts the smooth flow of traffic. Year by year, it is observed that the rate of accidents and mishaps in the hilly areas are rising. Driving in the hilly areas is not that easy even for experienced drivers owing to the difference in the topography of the hilly areas. The narrow roads and

the severe climatic conditions also make it very difficult and risky. Being more prone to landslides, floods and bridge breaks, the troubles are very evident. The hilly areas, known for their natural beauty are a hot spot for the tourists. As a result, it is not just the residents of these areas that face the trouble due to aforesaid reasons, but also the tourists. The tourists being unaware of the region are adversely affected. The problems faced by tourists are worse as they are unaware of the surrounding region. Also, a lot of hilly regions in countries like India are pilgrim centers, which attract a lot of devotees every year. The unreliability of GPS/GSM systems in hilly areas makes the condition even worse. Consequently, ensuring the safety in hilly areas and minimizing the occurrence or effect of landslides and floods is a necessity. Though, phenomenon like landslides and floods are natural calamities, we can at least try to issue a warning signal to the people concerned and thereby reduce the dire consequences.

Many technologies have been explored for use in systems built to enhance or monitor the safety in the hilly areas. Wireless sensor networks (WSN), VASNET [1], Vehicular ad-hoc networks, Cloud Computing, IoT and Machine to Machine Communication are some of the technologies employed to provide safety in hilly areas.

In this paper, we are going to discuss some of the technologies and techniques developed to enhance the road safety in hilly areas and to prevent or minimize the destruction caused due to landslides and floods occurring in these regions.

The rest of the paper is organized as follows; Section 2 discusses some of the previous approaches proposed to ensure safety and minimize the undesirable happenings in the hilly areas.

Section 3 gives the conclusion by suggesting the future possibilities.

2. LITERATURE SURVEY

Road safety in hilly areas, prevention of landslides and floods has always been a hot topic of research with many technologies being put to use in this regard. Some of the techniques aimed at providing safety in hilly areas are discussed here.

In [2], Machine to machine (M2M) communication in intelligent transportation is discussed. M2M is a technology which interconnects components like sensors, vehicles, road infrastructures and wireless networks. The aim is to reduce problems like road congestion, mishaps and high vehicle fuel consumption. The paper mentions that M2M used in intelligent transportation systems (ITS) improves road safety and efficiency. Vehicular ad-hoc networks (VANETs) play a significant role here. The M2M architectures devised find many applications like traffic light control, fleet management and smart grid systems.

J. Joshi et al in [3] proposed TMaaS: Traffic management as a service in vehicular networks. TMaaS is a concept involving VANET with Cloud Computing Services. This combination supports various real time applications like vehicle tracking, accident detection, lane changing, etc. A hardware prototype for vehicular speed and location tracking, efficient lane changing and accident detection on real time basis is also discussed in [3].

In [4], the different Applications of Wireless Sensor Network in Intelligent Traffic System are reviewed by the authors. It also discusses the goals set up to enhance the efficiency of actual systems. The diversified use of Vehicular network makes it a popular choice in aiding the development of a competent system to control and manage traffic flow and that. It suggests that WSN and Vehicular network have the potential of bringing revolutionary changes in transportation system.

In [5], C. Ye. et al. focuses on deep learning-based methods for landslide detection. They have used hyperspectral images. A deep learning two step framework with constraints to detect landslides on hyperspectral image is developed. In the first step, the deep belief network employed extracts the spectral-spatial features of a landslide and then secondly, the high-level features and constraints are inserted into a logistic regression

classifier for verifying the landslide. The accuracy of the landslide detection on the whole image, obtained by this method, can reach 97.91%. Also, this article reveals that the high-level feature extraction system has a significant potential for landslide detection, especially in multi-source remote sensing.

Ghat roads in the hilly areas are another hotspot for the accidents. The bends in the ghat roads are the most dangerous and are highly prone to accidents. In [6], the authors have tried to address this problem by suggesting the use of CCTV cameras and LED screens at the hairpin bends wherein the a CCTV and LED screen will be installed at either side of the bent road. The CCTV on the left side of the road will capture the traffic flow on the left side of the road and display it on the screen so that the traffic coming from the right side of the bend can act accordingly. The same will be followed for the traffic on the right side of the bend which will be displayed for the people coming from left side so that they act accordingly. The authors opine that this will help prevent the accidents on the hairpin bends at the ghat roads.

Another method proposed in [7] also addresses the problems of hairpin bends and steep curves. The system in [7], issues three stages of alerts based on the distance of the vehicle from the sensor position. Based on these alerts, the driver gets to know about the vehicle coming from the opposite side and hence can act accordingly. It also senses the speed with which the vehicle is approaching and with this information it becomes easier for the driver on the other side to vary the speed of his vehicle. As a result, the accidents are minimized at the curves and bends.

Many other techniques like an IOT based accident prevention unit (APU) [8], pre-crash system and warning system [9] also aims to address the safety issues in hilly areas.

Floods are also a reason for making the conditions worse in the hilly areas and inducing a loss of life and property. Flood, being a natural calamity can only be detected and an alarming signal can be issued in order to reduce the losses. Some of the flood detection, warning and alarming systems are discussed in [10], [11] and [12].

3. DISCUSSION

The safety in hilly areas is a big question owing to the rapid increase in automobiles, the sharp turn and accidental curves on the roads, the extreme weather conditions and calamities like landslides, floods etc. The roads in the hilly areas need to be constructed and maintained properly so as to minimize the accidents caused due to faulty roads. Proper signages, drainage, barriers and all other things which facilitate the driving must be properly installed at the required places. Also, the drivers need to be extra cautious and attentive while driving in these areas. A lot of research has gone in this regard to bring technology to the rescue. Technologies like VANET, adhoc networks, M2M communication, Cloud Computing, feature extraction have been used to minimize the undesired effects of the above mentioned reasons. However, the recent popular choice seems to be Wireless sensor networks and IoT. This can also be owed to the fact that recent advances in wireless communication have led to the development of low power, small and cost effective sensor networks.

The objective of all the techniques proposed is to provide or enhance the safety in hilly areas. The aim is to minimize the loss of life and property by issuing a warning signal to all the concerned well in advance. With many advances in technology, better safety monitoring systems are expected in future.

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