SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY

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ABTRACT — The Safe System (SS) approach to road safety emphasizes safety-by-design through ensuring safe vehicles, road networks, and road users. With a strong motivation from the World Health Organization (WHO), this approach is increasingly adopted worldwide. Considerations in SS, however, are made for the medium-to-long term. Our interest in this work is to complement the approach with a short-to-medium term dynamic assessment of road safety. Toward this end, we introduce a novel, cost-effective Internet of Things (IoT) architecture that facilitates the realization of a robust and dynamic computational core in assessing the safety of a road network and its elements. In doing so, we introduce a new, meaningful, and scalable metric for assessing road safety. We also showcase the use of machine learning in the design of the metric computation core through a novel application of Hidden Markov Models (HMMs). Finally, the impact of the proposed architecture is demonstrated through an application to safety-based route planning.

Keywords-

INTRODUCTION

In its Global Status Report on Road Safety – 2015, the World Health Organization (WHO) noted that the worldwide total number of road traffic deaths has plateaued at 1.25 million per year, with tens of million either injured or disabled [1]. Different initiatives, such as the United Nations' initiative for the 2011-2020 Decade of Action for Road Safety, have led to improvements in road safety policies and enforcements. However, the WHO notes that the progress has been slow and has maintained the call for urgent action to reduce these figures [2].

Added to the losses in human lives and wellbeing, considerable monetary losses are incurred in medical expenses, infrastructure repair, and production downtime. While the worldwide figures have plateaued, the Global Status Report does indicate higher road fatalities and injuries in low-income countries. Such disparity, as noted in [3], signals a barring-limitation in low-income countries to improve road-safety by adopting solutions implemented in high-income countries.

The Safe System (SS) approach to transport networks originated with the "Safe Road Transport System" model developed by the Swedish Transport Agency. In its essence, the approach migrates from the view that accidents are largely and automatically the driver's fault to a view that identifies and evaluates the true causes for accidents. Through the categorization of safety into the safety of three elements (vehicle, road, and road user), SS minimizes fatalities and injuries by controlling speeds and facilitating prompt emergency response. The model has been widely adopted since its introduction and is currently motivated by the WHO as a basis for road safety planning, policy-making, and enforcement.

LITERATURE REVIEW

An IoT Architecture for Assessing Road Safety in Smart Cities ,November 2018 Wireless Communications and Mobile Computing 2018:1-11 by Abd-Elhamid M. Taha proposed Safety road system to transport network originated with the "Safe Road Transport System" model developed by the Swedish Transport Agency.

Development and Testing of Road Signs Alert System Using a Smart Mobile Phone by Ramadhani Sinde proposed Road traffic accidents (RTA) are defined as accidents that occurred or originated on a way or street open to public traffic. These collisions result in injury or death between automobiles or humans . RTA is a major problem worldwide resulting in significant morbidity and mortality. According to the World Health Organization road safety report of 2018, the number of road traffic deaths increased to 1.35 million in 2016 .

Reliable Smart Road Signs Muhammed O. Sayin, Chung-Wei Lin, Eunsuk Kang, Shinichi Shiraishi, and Tamer Bas¸ar, e a game theoretical adversarial intervention detection mechanism for reliable smart road signs. A future trend in intelligent transportation systems is "smart road signs" that incorporate smart codes (e.g., visible at infrared) on their surface to provide more detailed information to smart vehicles. Such smart codes make road sign classification problem aligned with communication settings more than conventional classification.

J. Jin, K. Fu, and C. Zhang, "**Traffic sign recognition with hinge loss trained convolutional neural networks,"** IEEE Transactions on Intelligent Transportation Systems, vol. 15, no. 5, pp. 1991–2000, 2014, the authors have studied convolutional neural networks trained according to hinge loss stochastic gradient descent to achieve fast and stable convergence rates with substantial recognition performance. , however, in this paper, we seek to address the latter challenge, i.e., road-sign classification in adversarial environments, where there can be an intelligent attacker modifying road signs physically as exemplified .

Smart Safety and Accident Prevention System for Mountain Roads By Dwaipayan Saha proposed Arduino based vehicle accident detection system was proposed as an approach towards avoiding road accidents. In this proposed model Arduino ,GSM ,GPS, LCD, vibration sensors were used . In this system vibration sensor is used as an input source to system which is analyzed by the Arduino and when the sensor reading exceeds the normal or threshold appropriate action starts taking place as it will direct the GSM to send messages from the user mobile to the authority as they can send immediate help to the accident victims.

Smart Road Safety and Vehicle AccidentPrevention System for Mountain Roads by Lavanya proposed y. The main cause of all these accidents are negligence , negotiation of safety measures etc. As technology is getting advanced in a greater speed safety measures also being modified but still accidents are still happening. Earlier various steps were taken to prevent those accidents but still accidents were occurring at a higher rate. GPS(Global Positioning System) and GSM(Globalization Management System) wereintroduced but both of these were useful after accidents had happened as GPS is used to give information regarding the location and GSM is useful for sending messages from the users mobile to indicate the authority that accident happened. GPS and GSM are used for indicating that accidents occurred but our proposed model is an exception to all this as it prevents the accident fromoccurring and thus saving lives

Aravinda B, Chaithralakshmi C, Deeksha, Ashutha K from their report, it is concluded Accident prevention in U-turn, S-turn, hilly Ghats and mountain roads using modern sensor technology, Which uses Aurdino UNO, Ultrasonic sensor, RF module LED etc.

R.Saranya, R.Arun Kumar This paperconclude that, JAC : A Journal Of Composition Theory Volume XIV, Issue VIII, AUGUST 2021 ISSN : 0731-6755 Accidents may takes place in various factors drunk and driving, Texting while driving, Speeding, Distractions, Sleeping while driving. Among Drowsiness is reason for most of the accidents. While driving at the speed of 100km/hr.driver falls sleepy within 4 seconds the buzzer will enables.

Ranga Sreedhar Galla has studied the basic aim oftheir paper is to reduce accidents on hilly and slippery roads.In curve roads the other road end of vehicle cannot seen bydriver. At night time accidentsmay happens by intensity ofhead light from opposite side of vehicles. Also, the lightintensity problem occurs both curved roads and mountain roads; Thousands of people lose their lives. The solution forthis problem is alerting the driver about the vehicle comingfrom opposite side. This is done by keeping an ultrasonicsensor in one side of theroad before the curve and keeping aLED light after the curve, so that if vehicle comes from one end of the curve sensor senses and LED light glowsat the opposite side

Kartik Venkata Mutya, Sandeep Rudra has studied that road traffic accidents are being recognized as a major public health problem in numerous countries with alarmingly increasing fatalities in developing countries. Careless driving as a result of excessive waiting and blind corners is attributed as one of the most important factor for all road accidents. An estimated 1.2 million people lose their lives in road traffic crashes every year, and another 20 to 50million are injured. A docile, economical mechanism top revent these road accidents is the need of the hour. It is hoped that the mechanism presented in this article would help in alleviating this concern especially in correspondence with large vehicle accident.

CONCLUSION

This work illustrates the viability of an economic road safety monitoring and assessment solution through exploiting advances in the Internet of Things (IoT) within the context of smart cities. The introduced architecture facilitates robust and dynamic road safety assessment that complements the Safe System approach motivated by the World Health Organization (WHO), which has been increasingly adopted worldwide. An application of the dynamic assessment framework for route planning is also demonstrated.

Future work involves exploring further applications, especially in the context of raising driver awareness of the road safety conditions during their trips.

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