Ann. For. Res. 65(1): 12214-12220, 2022
ISSN: 18448135, 20652445

ANNALS OF FOREST RESEARCH
https://www.e-afr.org/

ADVANCED STUDY OF SMART ROAD SAFETY USING SENSOR TECHNOLOGY

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ABSTRACT

Today, injuries sustained in motor vehicle accidents are one of the top causes of fatalities, impairments, and hospitalisations throughout the nation. The road network in India is one of the biggest in the world, with around 56 million km as of March 2016. During the calendar year 2017, the states and union territories (UTs) combined to record a total of 4, 64,910 road accidents, which resulted in the deaths of 1,47,913 people and injuries to 4,70,975 others. According to these numbers, there are an average of 1274 accidents and 405 fatalities per day, which breaks down to 53 accidents and 17 fatalities every hour throughout the nation. At least one person loses their life in a motor vehicle collision per minute on average. At least ten million individuals are injured each year as a result of automobile accidents, with two to three million of those injuries being considered severe. It is anticipated that the expense of medical care, repairs to destroyed property, and other expenditures will amount to one percent to three percent of the global gross domestic product. Pre-crash sensing is rapidly becoming a field of active study among automobile manufacturers, suppliers, and universities, with the goals of lowering the number of injuries and the severity of accidents. Descriptive and experimental investigations that support inquiry techniques to have a thorough understanding of the issue were used as the research methodology for the current endeavor. This included historical study, content analysis, and experimental verification. After the issue has been defined, data has been gathered from a variety of sources, including open-ended questions that are included and online sites for data on road accidents, such as the Ministry of Road Transport and Highway of the Government of India. The main causes of traffic accidents and the requirements for collisions were examined. A safety bit-based method was designed in step 5. Simulated the safety application using various network settings in various scenarios, including city, highway, and junction scenarios. Simulated outcomes, lab and field test trails, and a performance comparison of the safety strategy were done in steps 8 and 9, respectively. The thesis was the culmination of the research.

Key: advanced, Smart, Road, Safety, Sensor, Technology.

INTRODUCTION

Today, injuries sustained in motor vehicle accidents are one of the top causes of fatalities, impairments, and hospitalisations throughout the nation. The road network in India is one of the biggest in the world, with around 56 million km as of March 2016. During the calendar year 2017, the states and union territories (UTs) combined to record a total of 4,64,910 road accidents, which resulted in the deaths of 1,47,913 people and injuries to 4,70,975 others. According to these numbers, there are an average of 1274 accidents and 405 fatalities per day, which breaks down to 53 accidents and 17 fatalities every hour throughout the nation. At least one person loses their life in a motor vehicle collision per minute on average. At least ten million individuals are injured each year as a result of automobile accidents, with two to three million of those injuries being considered severe. It is anticipated that the expense of medical care, repairs to destroyed property, and other expenditures will amount to one percent to three percent of the global gross domestic product.

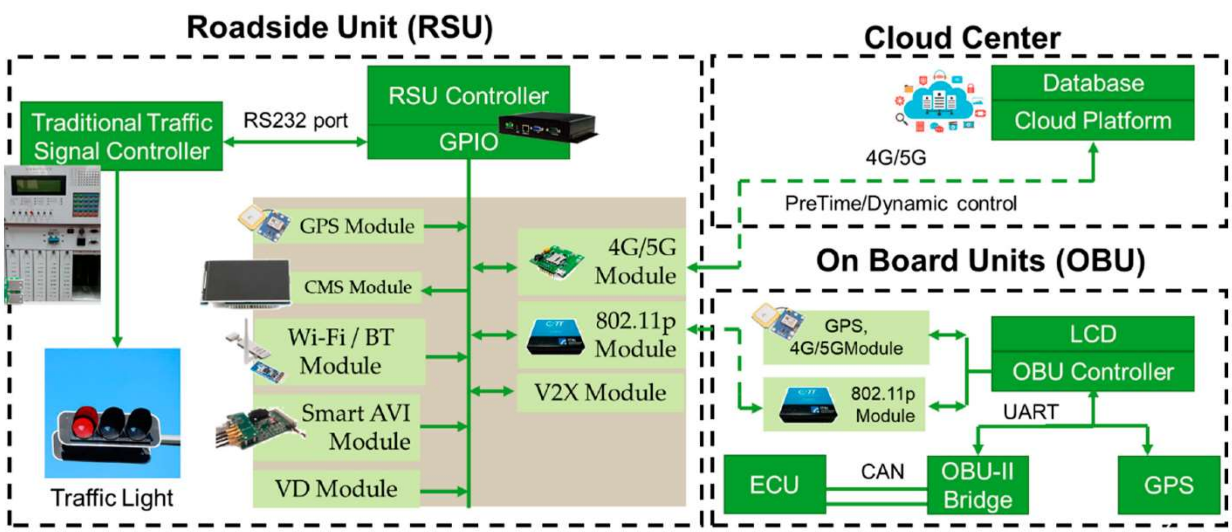


Fig.1: ADVANCED STUDY OF SMART ROAD SAFETY USING SENSOR TECHNOLOGY FLOW.

Pre-crash sensing is rapidly becoming a field of active study among automobile manufacturers, suppliers, and universities, with the ultimate goal of lowering the number of injuries and the severity of accidents. According to data on car accidents, the most significant dangers that a driver faces come from other drivers and their cars. An automated accident detection system involving automobiles is the subject of the proposed system. This system would communicate information about the accident, such as the position, the time, and the angle of the collision, to a rescue team such as a first aid centre and the police station.

An alert message with this information will be sent to the recipient. However, in circumstances in which there has been no loss of life, a switch has been installed that the driver may use to turn off in order to stop the alarm message from being sent. In order to transmit the warning message, a GSM module is utilized, and a GPS module is used in order to determine the precise position of the accident. Serial communication is used to establish a connection between the control unit and the GPS and GSM modules.

SMART SYSTEMS FOR ROAD SAFETY

In today's society, there is a growing sense of urgency about the subject of road safety. Road safety measures are necessary in emerging and under developed nations primarily due to a lack of appropriate infrastructure and the implementation of roads in the country. The majority of developed countries have adequately designed roadways and road traffic management systems. However, the majority of developing countries do not. In a nation like India, the majority of the country's largest cities are centres of the information technology industry and are home to significant commercial and manufacturing districts. As a direct consequence of this, the urban areas have an exceptionally high number of cars and trucks on the road. According to the findings of a statistical study, there has been a significant rise in both the annual total number of accidents and the annual total number of fatalities that may be attributed to road accidents.

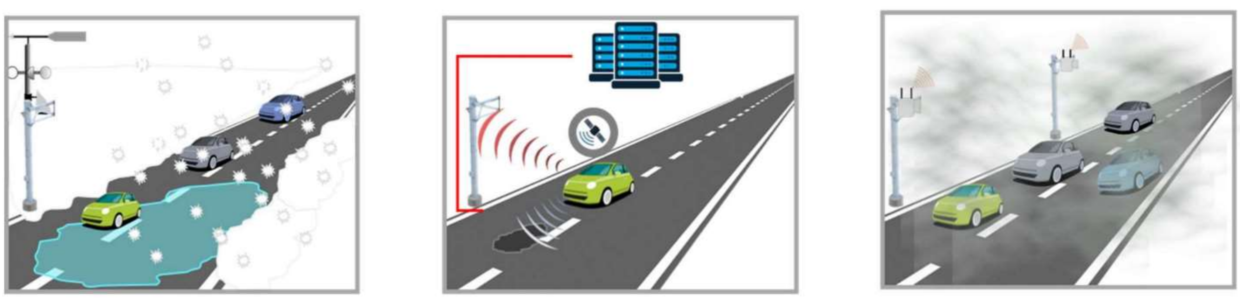
Fig.2: ADVANCED STUDY OF SMART ROAD SAFETY USING SENSOR TECHNOLOGY PROCESS

Speed Interceptors

Devices known as speed interceptors are fitted inside of traffic police vans in order to assist officers in catching motorists who are driving too quickly on public highways. The date, the time, the speed limit, the actual speed, the location, and the vehicle registration number may all be shown on the speed interceptor device. If it determines that a vehicle is going above the posted speed limit, this gadget will immediately produce a ticket for the driver. This gadget has the extra benefit of taking a snapshot of the car in question as supporting evidence in the event that a violation has been committed. The cities of New Delhi and Bengaluru in India are among those that have already put this system into place. Typically, the interceptors are positioned around road bends or sections of vacant road where people are unable to adhere to the routes excessive speed restrictions.

Smart Street Lighting Systems

The installation of lighting systems is an essential component of urban infrastructure. Low visibility on the roads at night is another primary factor in the incidence of traffic accidents. As a result of this need, suitable street lighting systems are required to be included in road safety systems. When faced with an energy crisis that is steadily becoming worse, one must give careful consideration to the issue of cost. Failures and a lack of consistent monitoring and maintenance contribute to inefficiencies in the functioning of traditional street lighting systems, which means that these systems are not very efficient. Because of this, there is a need for intelligent lighting systems that can automatically react to the various lighting needs. There is room for improvement in the current road lighting systems. Only the components of the system that are absolutely essential may be updated, which results in a higher energy efficiency at a cost that is affordable.



a) b) c)

Fig 3: ADVANCED STUDY OF SMART ROAD SAFETY USING SENSOR TECHNOLOGY METHOD

RESEARCH METHODOLOGY

Descriptive and experimental investigations that support inquiry techniques to have a thorough understanding of the issue were used as the research methodology for the current endeavor. This included historical study, content analysis, and experimental verification. After the issue has been defined, data has been gathered from a variety of sources, including open-ended questions that are included and online sites for data on road accidents, such as the Ministry of Road Transport and Highway of the Government of India.

The main causes of traffic accidents and the requirements for collisions were examined. A safety bit-based method was designed in step 5. Simulated the safety application using various network settings in various scenarios, including city, highway, and junction scenarios. Simulated outcomes, lab and field test trails, and a performance comparison of the safety strategy were done in steps 8 and 9, respectively.

The thesis was the culmination of the research. With the monitoring of the working module's execution for a certain amount of time, issues have been solved using the simulation mechanism. For instance, one may run simulations and record the results to analyse the operation of 802.11p DSRC protocols for VANETs. These parameters include Packet Delivery Ration (PDR), throughput, End-to-End (E2E) latency, and packet loss. Simulators Network Simulator (NS2) and Simulation of Urban Mobility (SUMO) 0.22 are used to analyse the suggested method. It is important to remember that NS2 is the chosen option since it is the most popular free, open-source simulation operating because of its quality of being open source, accessible any changeable source as per the user demand, and written in C++ and the Object Tool Command Language (OTCL). For Visakhapatnam City, the deployment of VANETs with real-time traffic was started. Using SUMO, the Java Open Street Map (JOSM) map was transformed into a real-time traffic situation. The SUMOgenerated traffic files were exported to NS2.

Safety Algorithm

The road network in Visakhapatnam, India, which is regarded as the real-time road network, is simulated using the open-source, real-time traffic simulator known as SUMO Simulator. How to respond to a rear-end collision: 1. Start 2. Read local and neighbor vehicle position details 3. Set brake state to the ideal 4. Set Safe range, warning range, and danger range to ideal 5. Set TTC, TTA to zero 6. While True • Compute the distances • V-front, Vrear, V-left & V-right Compute PoI • Calculate TTC and TTA • Assign Margin Time based on TTC 7. Provide the motorist a clear and safe message if the margin of time is more than the level of safety. 8. Provide a strong warning to the motorist to decrease speed if the margin time is restricted and modest.

CONCLUSION

There will be property and bodily damage, and in the worst cases, loss of life, as a result of any accident. This research suggests a safety model to lessen the likelihood of harmful incidents like crashes. The suggested system calculates the separation between cars and sounds an alarm in those that are close by. Using information from a GPS receiver, we devised a computational method based on the time it takes to collide and the time it takes to avoid it. With this information, an informed choice is made depending on the distance between any two cars. Future research may consider vehicle dynamics and environmental data to anticipate the likelihood of collisions more precisely, allowing for active Safety to be bolstered rather just passive Safety. As part of the PHY channel characterization, physical data transmission method as described by IEEE 802.11p, and pilot types have been studied to estimate the channel, it has been debated how useful OFDM is with preference to different modulation schemes, with focus on BPSK. In the context of this study, the need of NS2 simulation was found to be a matter of taste.

We deployed a fleet-wide safety application and analyzed its performance. Safety applications including rear-end collision and abrupt brake were analyzed using computer simulations in a variety of settings including city, highway, and the junction with varying vehicle densities. The SUMO procedure to create a trace file for it’s built in utility has been carried out so that traffic data may be moved around with ease. With IEEE 802.11p WAVE, NS2 provides compatibility for both outdoor base unit (OBU) and radio system unit (RSU) nodes. Using the free street map editor as a starting point, SUMO and NS2 have been combined to create a traffic simulation of Visakhapatnam. The safety application's efficacy was then assessed. We provide solutions for Intelligent Network Applications by bridging the gap between LTE's long-range communications and 802.11p's short-range communications.

FUTURE ENHANCEMENT

The planned automated system must be implemented on Indian roadways immediately. Vehicle mechanisms should be adjusted or created to reduce vehicle velocity when the driver is sleepy. It's important to keep an eye on the driver's pulse rate, drop a gear, and find a safe parking spot. In order to prevent unanticipated problems, the emergency call or emergency alert message must be transmitted to the control room. In order to use the gadgets or sensor devices, you must buckle up, place your fingers on the wheel, etc. It will be simple to transport and helps us prevent mishaps. Wearing a seat belt when driving should be essential. An alarm or other warning to fasten your seatbelt has 193 recently been developed. Devices or sensors of the future will likely be fastened to the safety belt. Wearing a seatbelt is mandatory, and in order to monitor your heart rate, a tiny device will be automatically inserted in your seatbelt.

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