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# **A Smart Vehicle to Vehicle Communication System Integrating LiDAR and Radar Technology with Machine Learning For Proactive Accident Detection**

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**ABSTRACT:** This challenge proposes the development of an advanced clever vehicle-to-car (V2V) conversation system aimed at improving avenue safety through proactive twist of fate detection. The LiDAR and Radar technology, in conjunction with the software of machine getting to know algorithms. The objective is to create an shrewd and responsive community among cars to mitigate injuries with the aid of detecting ability collision situations in real-time. To enhance the machine's intelligence, device mastering algorithms are employed for information analysis and decision-making. LiDAR offers high- precision distance measurements, capturing particular 3D facts approximately the vehicle's surroundings, while Radar contributes to item detection and monitoring, especially in unfavorable weather situations. The real-time information from LiDAR and Radar sensors are continuously processed, permitting the machine to predict and proactively pick out conditions with a high threat of injuries. The V2V communication aspect permits vehicles to exchange critical statistics approximately their positions, speeds, and trajectories. by way of integrating LiDAR, Radar, and machine mastering in a V2V conversation framework, the proposed machine strives to prevent accidents before they arise, thereby improving general road safety and lowering the severity of collisions. The gadget contains automobile battery strength monitoring, accessible through a web IoTinternet page, making sure non-stop operation and presenting notifications for choicest renovation. Integrating an internet digital camera for actual-time video capture and an ADXL sensor for monitoring automobile acceleration X, Y, Z axis complements the V2V machine's accident detection talents. The web camera presents visible context, whilst the ADXL sensor detects sudden modifications in acceleration, triggering video recording at some stage in capability accidents and keep in database.

## **I.INTRODUCTION**

A Smart Vehicle-to-Vehicle (V2V) communication system integrating LiDAR and radar technology with machine learning for active accident detection addresses the critical need for advanced traffic safety measures. This project is a future where vehicles intelligently communicate with each other and use state-of-the-art LiDAR and Radar technologies along with machine learning algorithms to proactively detect and mitigate potential collision scenarios. LiDAR and Radar sensors provide comprehensive and accurate perception of the vehicle's environment, real-time distance data, object detection and tracking. The fusion of these technologies forms the basis for an advanced perception system that can analyze complex traffic scenarios. The communication aspect of the V2V system improves between vehicles and enables the exchange of critical information such as positions, speeds. The integration of advanced sensor technologies and machine learning is a commitment to the development of intelligent transportation systems that prioritize safety, efficiency and reducing the overall impact of traffic accidents. This innovative project presents an advanced Smart Vehicle-to-Vehicle (V2V) communication system designed to significantly increase road safety through proactive accident detection. Utilizing state-of-the-art LiDAR and Radar technologies combined with sophisticated machine learning algorithms, the system aims to create an intelligent network between vehicles. By seamlessly integrating high-precision distance measurements and object detection capabilities, the system proactively identifies potential collision scenarios in real-time, promoting a safer driving environment.

## II.OBJECTIVE

- The main objective of this project is to design and implement a system that can proactively detect potential collision scenarios between vehicles using advanced technologies such as LiDAR and Radar.
- Integrate LiDAR and Radar technologies to create an intelligent perception system that provides comprehensive understanding of the vehicle's surroundings, real-time object detection and spatial mapping capabilities.
- A vehicle-to-vehicle communication network that facilitates real-time exchange of critical information between vehicles and promotes better situational awareness.
- Implement real-time vehicle battery monitoring through an Internet of Things (IoT) framework that enables continuous monitoring and management of battery health to optimize vehicle performance and reliability.
- The use of a web camera and ADXL sensor in vehicles aims to improve the crash detection system by providing real-time visual context along with monitoring sudden changes in vehicle dynamics.

## III.LITERATURE SURVEY

Multipath component (MPC) tracking within V2V communication channels has also become a key area of research. Notable studies, including the study by [1], have used various machine learning techniques to achieve real-time MPC tracking. This research is helpful in improving the reliability and robustness of V2V communication systems by providing insight into the dynamic nature of multipath propagation. [1] The integration of machine learning into V2V communication is a growing area of interest. They have previously used machine learning techniques for various aspects of V2V communication, demonstrating its potential in solving complex scenarios. The use of back-propagation neural networks (BPNNs) for scenario identification in V2V communications, as proposed in the abstract, is in line with the broader trend of applying neural networks in communication systems. [2]. By supporting autonomous driving and quickly connecting vehicles, these problems can be alleviated. CAVs help eliminate traffic accidents, alleviate traffic congestion, maximize vehicle awareness, reduce fuel consumption and gas emissions, and provide a safer and more comfortable experience. In recent decades, great progress has been made in the field of wireless technology and automotive communication to achieve the goal of autonomous and connected driving. [3]. For example, a modern autonomous vehicle can sense and communicate with its surroundings to ensure safe driving. In addition, wearables can detect passenger health emergencies and broadcast an alert to nearby vehicles accordingly, communicate with an emergency attendant, and navigate seamlessly using smart light signals. An intelligent vehicle can autonomously perform protective actions by broadcasting its location and also stop the vehicle. [4]

## IV.EXISTING & PROPOSED SYSTEM

### 1. EXISTING SYSTEM

- The integration of various technologies, including automotive networks, communication interfaces and modern hardware devices, could cause the complexity of the whole system.
- Ensuring the reliability of such a complex network is a significant challenge, as any communication or hardware failure could compromise the safety and functionality of CAVs (connected and autonomous vehicles).
- Reliance on information and communication technology in CAV opens up vulnerability to cyber security threats.
- Because CAVs are heavily dependent on communication interfaces, there is an increased risk of cyber-attacks that could potentially tamper with or disrupt the functioning of the vehicles, leading to security concerns.

### 1.1 DISADVANTAGES

- Traffic accidents and traffic congestion are serious, economic problems faced by many metropolitan cities. By supporting autonomous driving and quickly connecting vehicles, these problems can be alleviated.
- Weather, air pollution and radiation sensor units will be integrated into the future OBCU.

### 2. PROPOSED SYSTEM

- In this proposed v2v communication method is used when any emergency condition means vehicle wants to communicate with other vehicle using IOT technology.
- Here the sensed data can be stored in the cloud, if any abnormal condition is detected, it means the information should be transmitted through the API key and the notification will be received by another vehicle.
- The LIDAR sensor is used to detect the distance of the object and the speed of the vehicle.
- The radar technology is interfaced with the GUI, it detects obstacles in 360° and rotates the sensor using a servo



motorthat is interfaced with the processing software.

- IoT platform integration to provide an online website interface for vehicle battery health monitoring, facilitating remote access and real-time alerts for proactive maintenance and optimization of battery health.
- The webcam improves real-time situational awareness by providing visual surveillance of the vehicle's surroundings. Meanwhile, the ADXL sensor monitors sudden changes in vehicle dynamics, such as impacts, which are crucial for identifying potential accidents.

2.1 ADVANTAGES

- V2V communication enables real-time exchange of information between vehicles, enabling rapid response in emergency situations.
- LIDAR sensor and radar technology contribute to greater safety by providing accurate object distance, speed detectionand 360° obstacle detection.
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V. BLOCK DIAGRAM

1. TRANSMITTER BLOCK DIAGRAM

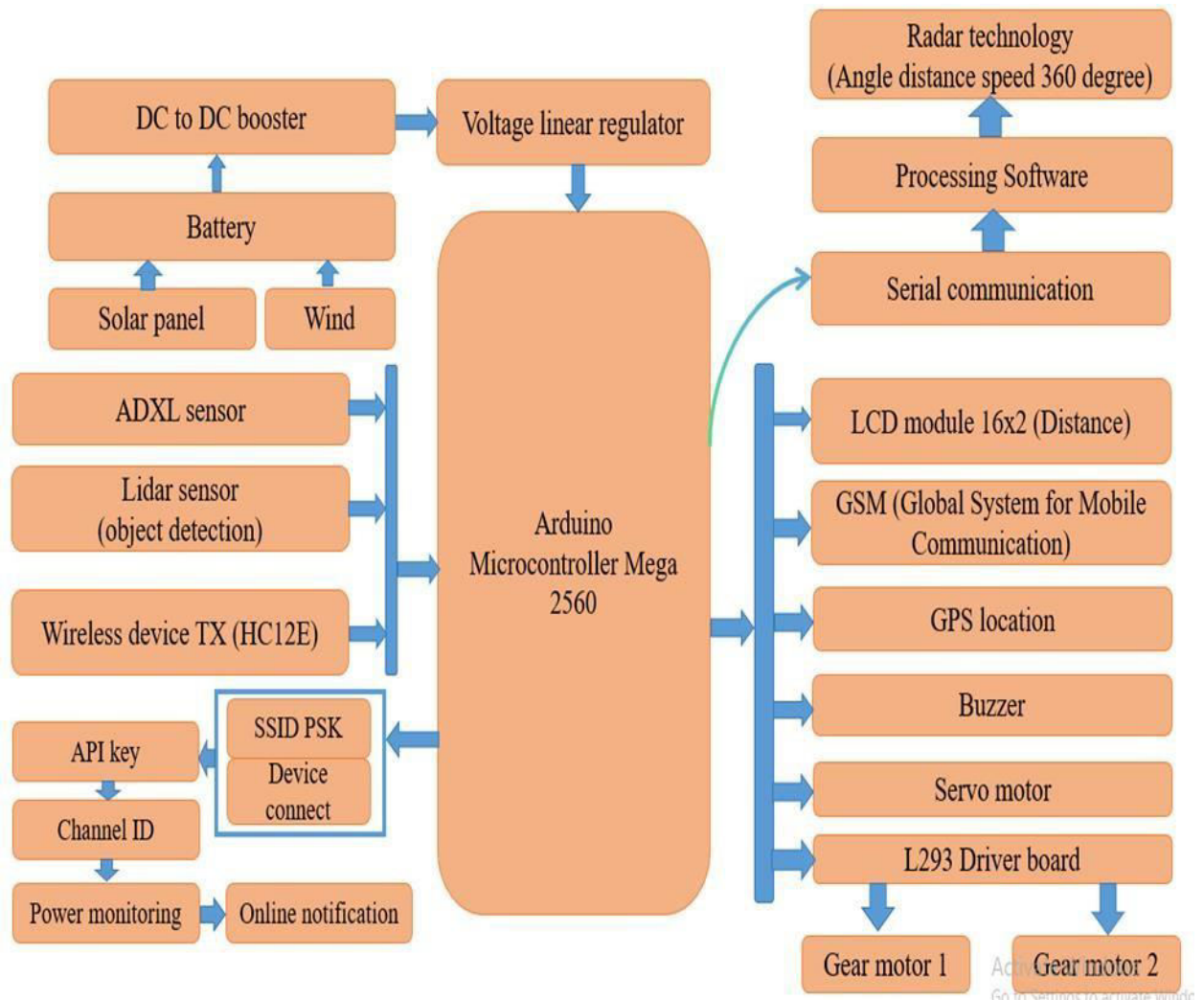


Fig no: 1 Transmitter block diagram

2. RECEIVER BLOCK DIAGRAM

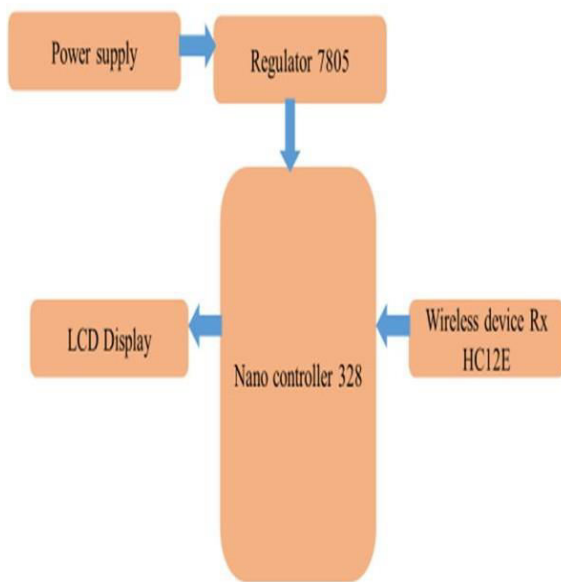


Fig no: 2 Receiver block diagram

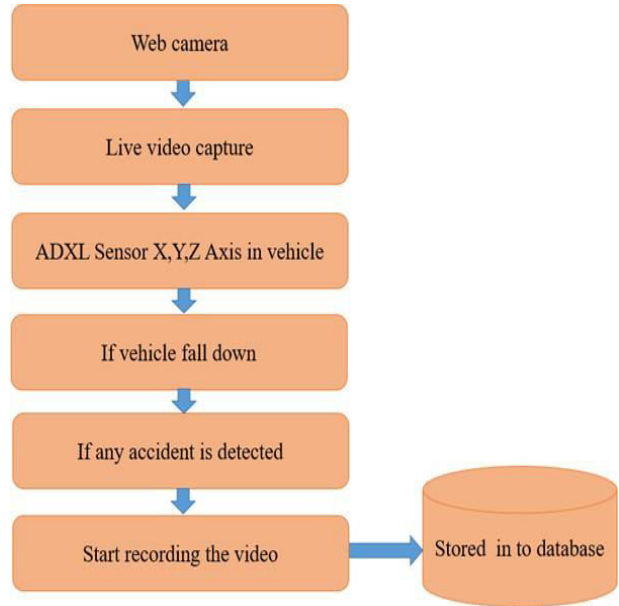


Fig no: 3 Software block diagram

VI.HARDWARE REQRUMENTS

1. Arduino Mega 2560

A microcontroller board like "Arduino Mega" depends on the ATmega2560 microcontroller. Contains digital input/output pins-54, where 16 pins are analog inputs, 14 are used as PWM outputs, hardware serial ports (UARTs) 4, crystal oscillator-16 MHz, ICSP header, power connector, USB connection, as well as RST button . This board mainly containseverything necessary to support the microcontroller. It is therefore possible to power this board by connecting it to a PC using a USB cable, or a battery or AC-DC adapter. This board can be protected from unexpected electric discharge by placing the motherboard. The SCL and SDA pins of the Mega 2560 R3 board connect next to the AREF pin. In addition, the two newestpins are located near the RST pin. One pin is IOREF which allows the shields to adjust the voltage offered from the Arduino board. The other pin is not associated and is kept for future use. These boards work with every existing shield, although they can adapt to the latest shields that use these extra pins.



Fig no: 4 Arduino Mega 2560 controller

2. TTP223 Touch sensor

HC-12 wireless RF UART verbal exchange module is a brand new generation of multichannel embedded wireless statistics transmission module. Radio frequency of 433.4 - 473.0MHz, can be putting verbal exchange channel, step is four hundred kHz, a complete of 100 channels. The module maximum transmit electricity is 100mW (20dBm), and -

116dBm receiver sensitivity air of the 5000bps baud price, communicate distance about 500 meters. The module adopts a stamp hollow encapsulation approach, which can be welded. The module size is 27.4mm\*thirteen.2mm \*4mm (including antenna seat, no longer together with the spring antenna), that's convenient for the patron to be embedded in the utility device. The module has a PCB antenna seat ANT1; customers can use the coaxial cable, the usage of 433MHz band outside antenna.

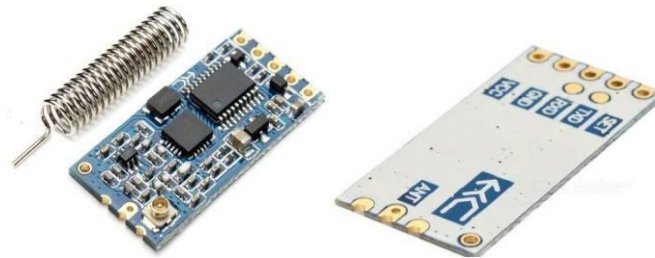


Fig no: 5 HC-12 Transmitter and receiver module

### 3. LIDAR SENSOR

Light detection and ranging (LiDAR), also known as laser detection and ranging or optical radar, is an active remote sensing technique that uses electromagnetic energy in the optical range to detect an object (target), determine the distance between the target and the device. . (range) and infer the physical properties of the object based on the interaction of the radiation with the target through phenomena such as scattering, absorption, reflection and fluorescence. LiDAR has many applications in the medical, engineering and military fields. LiDAR sensors have been deployed on fixed ground stations, mobile ground and subsurface vehicles, lighter-than-air craft, fixed- and rotary-wing aircraft, satellites, interplanetary probes, and planetary landers and rovers. This chapter provides a high-level overview of the operating principles of LiDAR technology and its main applications from space platforms such as satellite altimeter, atmospheric profiling, and on-orbit imaging and ranging.



Fig no: 6 Lidar sensor

### 4. SERVO MOTOR

A servo motor is a form of motor that could rotate with amazing precision. generally this sort of motor includes a manipulate circuit that gives feedback at the cutting-edge function of the motor shaft, this remarks allows the servo automobile to rotate with remarkable precision. in case you want to rotate an object at positive angles or distances, use a servo motor. It handiest includes a simple motor that runs thru a servo mechanism. If the motor is powered by way of DC electricity supply then it's far referred to as DC servo motor and if the motor is powered with the aid of AC then it's far called AC servo motor. on this tutorial we will simplest discuss the working of a DC servo motor. in addition to these predominant classifications, there are numerous different sorts of servo vehicles based totally on the form of equipment arrangement and working traits.





Fig no: 7 Servo Motor

### 5. ADXL345 SENSOR

The accelerometer and the gyroscope, they are primarily used to detect acceleration. While an accelerometer can measure linear acceleration, a gyroscope can help find rotational acceleration. A gyroscope is used to measure angular velocity, which uses Earth's gravity to determine the orientation of a moving object. There is a sensor like the MPU6050 that has both an accelerometer and a gyroscope and acts as an inertial measurement unit (IMU) to detect orientation, position and velocity. Here we are discussing ADXL345 accelerometer which is used to measure acceleration or change in velocity in x, y and z axes. These small sensors are used in vehicles and bikes to discover accidents to set off airbags and are also used in cellular telephones for diverse applications like is a compass and region tracker.

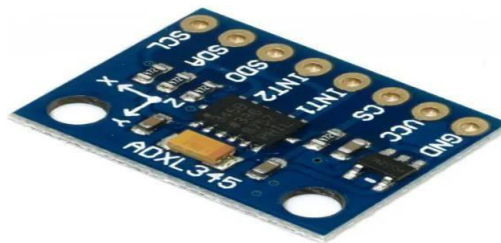


Fig no: 8 ADXL345 sensor

## VII. RESULT

The project successfully develops an advanced Smart Vehicle-to-Vehicle (V2V) communication system integrating LiDAR, Radar, Web Camera and ADXL sensor. This system increases road safety by proactively detecting possible collision scenarios in real time. LiDAR and Radar technologies provide accurate environmental data and reduce the risk of accidents. A webcam adds visual context for a comprehensive overview of the situation, while the ADXL sensor monitors vehicle dynamics and triggers video recording during critical events. This integrated approach aims to prevent accidents and reduce the severity of collisions, supported by 24/7 system operation through IoT-enabled battery monitoring and maintenance alerts.

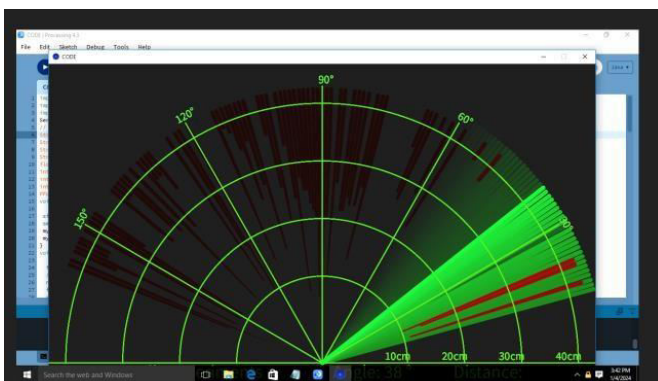


Fig no: 9 Radar signal

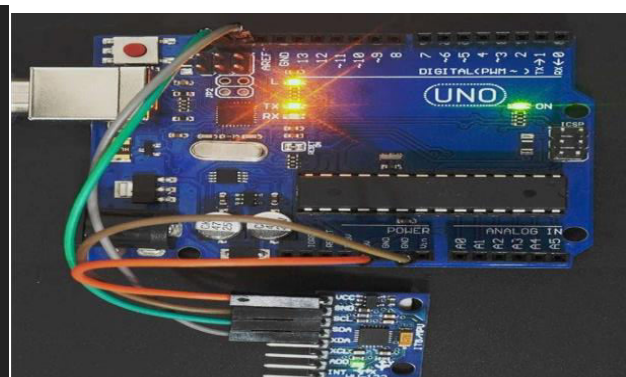


Fig no: 10 Arduino with axis sensor

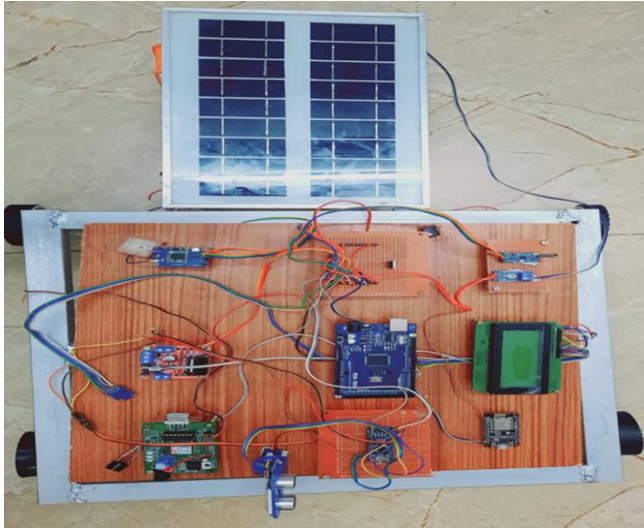


Fig no: 11 Transmitter side kit

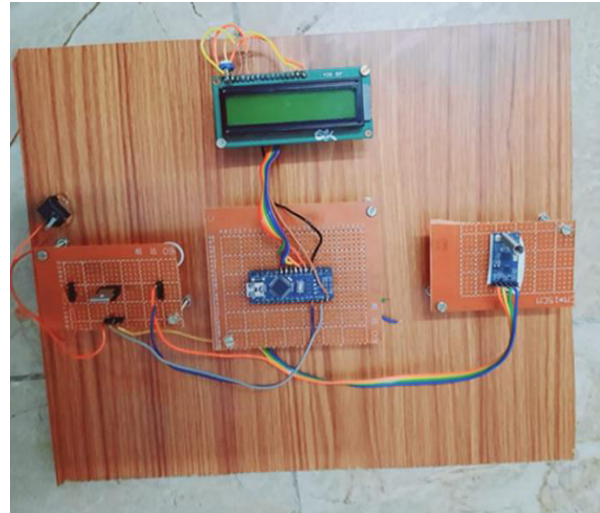


Fig no: 12 Receiver side kit

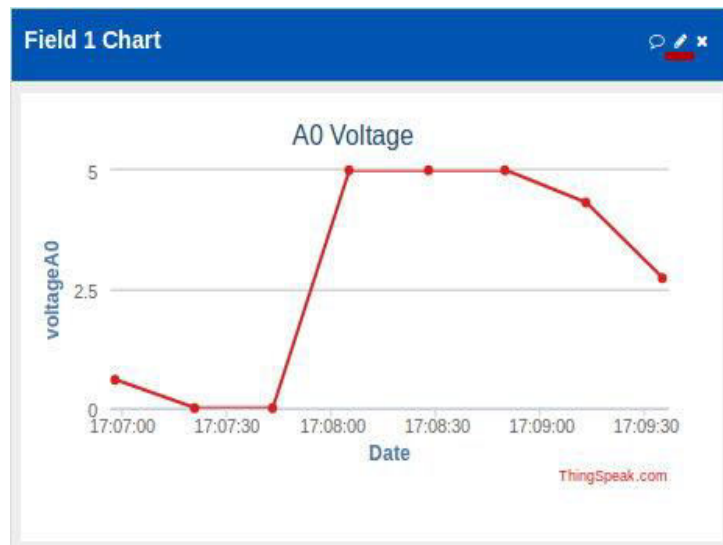


Fig no: 13 Thing speak web page

### VIII. CONCLUSION

The integration of LiDAR and radar technology with machine learning for active accident detection represents a key step in revolutionizing road safety. A fusion of advanced sensor technologies, including LiDAR and Radar, creates a robust sensing system that improves vehicles' awareness of their surroundings. This system is further enhanced with machine learning algorithms that allow it to analyze data sets and recognize patterns associated with potential collision risks. The creation of a communication network between vehicles expands the capabilities of the system, supports real-time information exchange and joint assessment of collisions between vehicles on the road. The project's emphasis on detecting imminent threats and automated responses such as automatic braking and evasive maneuvers underlines its commitment to proactive accident prevention. Collectively, these improvements envision a future where vehicles will intelligently communicate, anticipate potential hazards, and work together to prevent accidents before they happen, representing a significant step toward redefining vehicle safety standards.



**REFERENCES**

1. Global Status Report on Road Safety 2018: Summary, World Health Org., Geneva, Switzerland, 2018.
2. L. Quijano-Sánchez, I. Cantador, M. E. Cortés-Cediel, and O. Gil, “Recommender systems for smart cities,” *Inf. Syst.*, vol. 92, Sep. 2020, Art. no. 101545.
3. W. Sun, J. Liu, and H. Zhang, “When smart wearables meet intelligent vehicles: Challenges and future directions,” *IEEE Wireless Commun.*, vol. 24, no. 3, pp. 58–65, Jun. 2017.
4. J. Ferreira, M. Alam, B. Fernandes, L. Silva, J. Almeida, L. Moura, R. Costa, G. Iovino, and E. Cordiviola, “Cooperativesensing for improved traffic efficiency: The highway field trial,” *Comput. Netw.*, vol. 143, pp. 82–97, Oct. 2018.
5. I.W. Damaj, D. K. Serhal, L. A. Hamandi, R. N. Zantout, and H. T. Mouftah, “Connected and autonomous electric vehicles: Quality of experience survey and taxonomy,” *Veh. Commun.*, vol. 28, Apr. 2021, Art. no. 100312.
6. R. Molina-Masegosa, J. Gozalvez, and M. Sepulcre, “Comparison of IEEE 802.11p and LTE-V2X: An evaluation with periodic and aperiodic messages of constant and variable size,” *IEEE Access*, vol. 8, pp. 121526–121548, 2020.
7. Global Status Report on Road Safety 2018: Summary, World Health Org., Geneva, Switzerland, 2018.
8. L. Quijano-Sánchez, I. Cantador, M. E. Cortés-Cediel, and O. Gil, “Recommender systems for smart cities,” *Inf. Syst.*, vol. 92, Sep. 2020, Art. no. 101545.
9. W. Sun, J. Liu, and H. Zhang, “When smart wearables meet intelligent vehicles: Challenges and future directions,” *IEEE Wireless Commun.*, vol. 24, no. 3, pp. 58–65, Jun. 2017.
10. J. Ferreira, M. Alam, B. Fernandes, L. Silva, J. Almeida, L. Moura, R. Costa, G. Iovino, and E. Cordiviola, “Cooperativesensing for improved traffic efficiency: The highway field trial,” *Comput. Netw.*, vol. 143, pp. 82–97, Oct. 2018.



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