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Road Safety Enhancement System

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***Abstract*- Road accidents are a major global concern, which is often exacerbated by the delay in detection and response. The proposed Road Safety Enhancement System (RSES) will address this problem by incorporating real-time accident detection and alert mechanisms. Using computer vision, sensor networks, and GPS/GIS technologies, RSES identifies accidents through video analysis and changes in traffic patterns. The detection of an accident sends alerts to emergency services, traffic centers, and nearby drivers. This way, emergency response services, such as police, fire fighters, ambulance service, etc., are updated through location-based alerts; road traffic authorities receive real-time updates for proper management of traffic; and drivers can avoid such accident zones. RSES is working to develop an intelligent transportation system and smart city that can save lives and improve road safety.**

***Keywords:* Road Safety, Accident Detection, Intelligent Transport System (ITS), Sensors, Artificial Intelligence (AI), Traffic Monitoring Systems, Cost-Effective Safety Solutions, Thermal and Vibration Analysis, Real-Time Detection, YOLO Model, Image Enhancement, Sensor-Based Monitoring, Accident Detection System.**

1. INTRODUCTION

The fast-growing world population has rapidly increased the number of cars on the roads. This growth has increased mobility and accessibility but also led to a tremendous increase in road accidents. According to the World Health Organization, road traffic accidents claim approximately 1.35 million lives annually, with millions more injured or disabled. This is a very alarming figure that calls for road safety as a global concernBeyond human suffering, the effect of road accidents is economically huge; it costs the world over $1.8 trillion annually, adding pressure on healthcare systems, insurance costs, and expenses incurred in infrastructure repairs. This also leads to traffic congestion and delay as well as elevated air pollution, which goes to further aggravate public health and environmental sustainability.This has made the governments, policymakers, and stakeholders realize that something has to be done to meet this growing challenge. Traditional road safety management has some considerable drawbacks, though. Conventional road safety management systems mostly use manual data gathering, analysis, and reporting. It is time-consuming, error-prone, and resource-intensive. Traditional strategies mostly concentrate on reactive measures-ways of addressing accidents after they occur rather than developing proactive ways of preventing accidents from happening.

2. LITERATURE REVIEW

1) Title: Time Series Anomaly Detection in Vehicle Sensors Using Self-Attention Mechanisms

Author Names: Ze Zhang, Yue Yao, Windo Hutabarat, Michael Farnsworth, Divya Tiwari, and Ashutosh Tiwari.

Year: 2024.

Materials to be adopted for our Project:

- Sensor Anomaly Detection: The work is presenting a new anomaly detection algorithm, DSA-CNN, for detecting anomalies in the sensor data of connected autonomous vehicles, also known as CAV. This can be quite handy in your project wherein roadside sensors are going to monitor vehicle movements and possibly accidents.
- Real-time Alerts: You can adapt the concept of real-time anomaly detection to your system to trigger alerts to nearby warning lights and hospitals when an accident is detected.

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- Self-Attention Mechanism: You can use self-attention mechanisms to enhance the capability of your sensors to focus on specific patterns of movement that indicate potential accidents.

Challenges:

- Sensor Reliability and Accuracy: Getting reliable and accurate data from sensors under any given conditions (weather, light, etc.) may pose significant technological challenges.
- Real-Time Processing: Real-time processing of sensor data to raise the anomalies quickly enough to provide the alert will be a technology challenge.
- Implementation Costs: It may cost quite high in terms of deploying a significant number of sensors on highways and roads.

Overcome These Challenges:

- Regular Calibration and Testing: Adopt a maintenance schedule for the calibration and testing of sensors to ensure constant accuracy and reliability.
- Efficient Algorithms: Utilize algorithms that optimize processing speed and run on low-power hardware to support real-time processing.
- Funding and Partnerships: Seek funding opportunities through government grants, private partnerships, or collaborations with universities to reduce the financial burden.

Scope of This Paper:
The paper addresses the problem of detecting anomalies in multivariate time series data specifically in the context of connected and autonomous vehicles, which is crucial for enhancing safety and reliability. It opens avenues for further research in applying similar techniques for real-time monitoring and alert systems outside of the automotive context, such as in public safety systems [1].

Advantages:
Improved detection of subtle anomalies that leads to better safety outcomes.
Potentially reduces the number of undetected accidents through increased sensitivity in anomaly detection algorithms.

Disadvantages:
The reliance on a supervised learning model may limit flexibility in handling unknown categories of anomalies.
High computational requirements for processing data streams can limit the hardware choices.

2) Title: Cognitive-Based Crack Detection for Road Maintenance: An Integrated System in Cyber–Physical–Social Systems

Author names: Fan, Cao, Zeng, Li, Li, and Wang

Year: 2024

Materials to be adopted for our Project:

- The paper presents several relevant ideas applicable to the "Road Safety Enhancement System" project:
- Real-time data acquisition: The paper's theme of acquiring real-time data from sensors is directly applicable to the use of roadside sensors for the monitoring and detection of accidents.
- AI-driven anomaly detection: The utilization of AI algorithms in this paper to detect cracks may be used to develop the accident-detection algorithms. AI-based principles of anomaly detection highly apply to identifying unusual events, that is, accidents in the sensor data stream.
- Data augmentation: The simulated data applied to enhance the model's performance using AIDA algorithm of the paper would help achieve valuable strategies to improve the robustness and accuracy of the accident detection algorithms. Real-world data can be supplemented with simulated accident scenarios that train the model to be better in handling a greater variety of situations and less susceptible to noise in sensor data.

Challenges:
Several are expected to arise in implementing the "Road Safety Enhancement System":

- Precise detection of accidents: A number of difficulties arise in designing algorithms which can accurately detect accidents across a range of conditions-weather, lighting, types of accidents.
- Real-time processing and communication: It is very important that the system processes data and sends alerts in real-time for the system to be effective. Any kind of latency or failure in communication may severely hamper the ability of the system to provide timely warnings.
- System integration: Seamless integration of the sensor network, alert system, and communication with emergency services is required for the system to work as intended.
- Ethical considerations (animal safety): The animal safety aspect demands careful design to avoid harming animals, which necessitates research into effective and humane deterrent technologies.

Scope of the Paper:

- Strategies to address these challenges include:
- Robust AI algorithms: Implementing advanced machine learning techniques, including anomaly detection algorithms, and utilizing data augmentation to improve the reliability and accuracy of accident detection.
- Optimized system architecture: Designing a system architecture that emphasizes speed and reliability, including redundancy and fail-safes, to minimize the likelihood of system failures or delays.
- Thorough testing: Thoroughly testing the system under different conditions to find and fix potential problems before it's deployed.
- Consultation with experts: Consulting with animal welfare experts to design and test humane methods of deterring animals.

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The scope of the paper is only road maintenance, with the aim of crack detection specifically. It does not involve accident detection or animal safety.[3] Its methodologies are valuable for attaining those objectives.

Advantages:
The approach used by the paper offers several advantages transferable to the project.

- State-of-the-art AI approaches: The use of advanced AI algorithms serves as a basis for establishing accurate and robust detection.
- Data augmentation: This enhances the performance of the model, thus offering more reliable detection of events.
- Real-time processing: The real-time processing is important because accident and animal safety interventions are timely.

Disadvantages:
The primary disadvantage is the paper's limited direct applicability to accident and animal detection. Significant adaptation and expansion of its methods are required. The system's inherent complexity necessitates careful planning and integration to ensure reliability and avoid potential issues.

3) Title: Dynamic Loss Balancing and Sequential Enhancement for Road-Safety Assessment and Traffic Scene Classification

Authors Names: Marin Kaan, Marko Ševrović and Siniša Šegvić

Year: 2024

Materials to be adopted for our Project:

- Automated Risk Assessment: The core methodology in the paper—using computer vision to automatically identify road safety hazards—may motivate a future module in your system. Your current system focuses on reactive measures (accident response). Adding this paper's approach may be able to proactively identify the high-risk road segments, which might inform scheduling of road maintenance or even strategic placement of your sensors.

- Data-Driven Insights: The iRAP-BH dataset used within the paper demonstrates the impact of high-quality data for road safety improvement. You can combine data logging from your sensors to create an equivalent dataset relevant to your region. It can then be applied for predictive modeling of accident hotspots.
- Multi-task Learning: The paper employs a multi-task learning approach, improving the overall performance of the model. This could inspire the integration of multiple sensors and data streams into your system for a more holistic approach to road safety.

Challenges:

- Sensor Integration and Reliability: Integrating multiple sensors (cameras, accelerometers, etc.) will introduce complexities related to data fusion, sensor failure handling, and overall system reliability.
- Real-time Processing: Real-time processing of data from various sensors and timely alert triggering requires effective real-time processing capabilities.
- Data Analysis and Interpretation: The huge volume of data from your sensors will require strong data analysis techniques to extract meaningful insights and identify actionable information.
- Animal Wearable Reliability and Acceptance: Reliability and animal acceptance of the wearable belts will be critical.
- Cost and Scalability: A large-scale sensor network and wide-area animal wearables are costly and difficult to scale.

Overcoming Challenges:

- Sensor Integration: Use strong sensor fusion algorithms and redundant sensors to reduce the likelihood of a single sensor failure.
- Real-time Processing: Use high-performance computing hardware, such as embedded systems with GPUs, and optimize algorithms for speed.
- Data Analysis: Implement efficient data storage and retrieval mechanisms, and employ machine learning techniques for automatic data analysis and pattern recognition.
- Animal Wearable Reliability: Proper testing and iterative design improvement can enhance the reliability and acceptance of the devices by animals. One should consider using bio-compatible and comfortable materials.
- Cost and Scalability: Explore cost-effective sensor solutions and implement a phased deployment strategy, starting with smaller-scale deployments before scaling up. Seek funding opportunities and collaborations to mitigate costs.
  Scope of the Paper: The scope of the paper is limited to the automated assessment of road safety attributes using computer vision. It does not address real-time accident detection, emergency response, or animal safety measures [2].

Advantages:
Offers a proactive method of road safety risk identification.
It presents a data-driven approach for the improvement of road safety.

Disadvantages:
Does not relate directly to the real-time accident detection and response features of your project.
The computer vision approach is computationally expensive and might not be suitable for direct implementation in all environments.

4) Title: Pedestrian Protection Systems: Issues, Survey, and Challenges

Author Name: Gandhi and Trivedi

Year: (Probably) 2007

Paper Ideas for our Project:

- Sensor Technology for Accident Detection: The paper comprehensively reviews several sensor technologies currently employed in pedestrian protection systems-Visible light sensors, IR sensors, laser scanners and multi-sensor

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fusion approaches. The same work is directly applied for your roadside sensor system with selection of suitable sensor types and methods related to accident detection-vehicle collision and collision with pedestrians or animals (Table V). In terms of the pedestrian detection that utilizes multiple sensors, the approach can be significantly effective for your system design.

- It presents the driver warning systems as well as automatic braking in emergency response mechanisms. Whereas your system would alert and involve broader emergency response to service people involved, the discussion on immediate notification in active safety in that paper makes a relevant aspect to include. Evaluate on the time scale within which it takes for your alert system to operate effectively.
- Infrastructure-Based Systems: The paper shows what's possible with infrastructure-based systems (your roadside sensors) in conjunction with a vehicle-based system for full scene monitoring. This paper's discussion around the "Dynamic State Map" concept focused on intersections, but there are implications here which apply to designing your roadside sensor network and data integration as well.
- Passive Safety Systems: The paper on passive safety features or vehicle design changes has little direct application to your system but adds background information on the broader issue of road safety. A general appreciation for accident mechanisms and mechanics helps dictate the location of sensors and sensor sensitivities needed for a system to function effectively.

Challenges:

Sensor Reliability and False Positives As has been discussed in the paper, obtaining a very high rate of detection with false alarm minimized is a tough ask. Weather, lighting conditions, sensor limitations, or a complexity in the accident scenarios may cause false positives or even missed detections.

- Data Transmission and Communication: Communication among roadside sensors, warning lights, and emergency services needs to be real-time and low-latency. The challenges are network connectivity, signal strength, and the speed of data processing. Communication requirements in traffic scenarios have been discussed along with possible challenges in different kinds of environments.
- Animal Safety Belt Implementation: The feasibility and effectiveness of a wearable animal safety belt warrant in-depth investigation. Practical challenges include animal behavior, belt design (comfort, durability, and avoidance of entanglement), and the effective range of the warning sound.
- Cost and Scalability: Deploying a large-scale system across many roads will be costly. The paper cites expensive sensor technologies, such as laser scanners. Finding affordable sensor solutions and a feasible funding model is crucial for the widespread deployment.

Challenges Overcome:

- Sensor Fusion and Advanced Algorithms: Multiple types of sensors and complex signal processing and machine learning algorithms may reduce false positives and improve the reliability.
- Robust Communication Infrastructure: Designing a redundant communication network, such as cellular and satellite, with suitable data encryption and error correction will enable reliable and timely data transfer.
- Animal Safety Belt Design and Testing: Thorough testing and design iteration are essential in developing a practical and animal-friendly safety belt. It is recommended to involve the animal behavior experts in designing the belt.
- Phased Implementation and Funding Strategies: Start with a pilot project in a limited area and gradually expand as funding permits, demonstrating the system's effectiveness to secure further investment.

  Scope of the Paper: In terms of scope, it focuses mainly on the technical aspects of pedestrian protection systems, which include sensor technologies and algorithms for pedestrian detection with design modifications in vehicles. The paper gives a summary of the current research carried out in this area and shows where challenges lie but certainly doesn't cover all points about road safety, such as protecting animals or emergency response policies [4].

Advantages:

- Gives a solid base in sensor technologies and algorithms related to accident detection.
- It gives an idea about the integrated systems, both infrastructure and vehicle-based.
- It also provides an insight into the challenges and possible solutions that are needed in developing such systems.

Disadvantages:

Mainly focuses on pedestrian safety and not on animal safety or emergency response.

- It lacks details about specific implementation aspects and communication protocols.
- Its age might mean some discussed technologies are now outdated or superseded by more advanced alternatives. A broader literature search is recommended.

5) Title: Image Enhancement Method Utilizing YOLO Models to Recognize Road Markings at Night.

Author Name: Christine Dewi, Rung-Ching Chen, Yong-Cun Zhuang, William Eric Manongga.

Year: 2024.

What idea or things can you use for your project from this paper:

- YOLO Algorithm for Real-Time Detection: The paper demonstrates using YOLO models (especially YOLOv8) for real-time object detection. This method can be adapted for detecting road signs, accidents, or other dynamic road events.
- Image Enhancement Techniques: Techniques such as Contrast Stretching (CS), Histogram Equalization (HE), and CLAHE could improve the clarity of sensor or camera feeds, particularly in low-light conditions.
- Dataset Development Process: The process to develop and train with an environment-specific dataset (such as Taiwan's road markings) can help guide the process of designing an environment-specific dataset for Indian roads or your project's focus area.

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- Smart Transportation Integration: It points out how better detection systems improve autonomous driving and smart traffic management applications, relevant for integrating smart alert systems into your project.

Challenges:
- Sensor Precision and Calibration: Ensuring sensors detect movements accurately in diverse weather and lighting conditions.
- Data Availability: Lack of a pre-existing dataset for Indian road scenarios or animal movement near roads.
- Real-Time Processing Constraints: High computational requirements for real-time alert generation and notification.
- Animal Behavior Prediction Integration: Development of dependable animal detection and response mechanisms.
- Cost and Implementation: Installation of strong roadside sensors; adoption by the community with wearable animal belts.

Overcoming Challenges:
- Sensor Testing and Iterative Calibration: Utilize several prototypes which are tested in different circumstances to hone the sensitivity and accuracy levels.
- Dataset Development: Collaboration with local authorities or even utilize public datasets for your specific application in gathering images and data.
- Hardware Optimization: Using optimized hardware and algorithms like YOLOv8 in order to provide the maximum real-time efficiency
- Animal Behavioural Study Research: Collaborate with wildlife experts for the design of the sound-based alerts with minimized false triggers.
- Cost Management: Consider grants or subsidies offered by government agencies or NGOs, focusing on road safety and wildlife conservation.

Scope of this paper:
The paper is the groundwork for developing high-performance road safety systems, by improving night-time road marking detection, using deep learning and image enhancement techniques. The research supports the development of smart transportation systems and autonomous vehicle navigation [4].

Advantages:
The object detection is highly accurate. YOLOv8 achieves 90% accuracy in nighttime detection.
Enhanced image quality because of advanced enhancement techniques. Real-time processing makes it suitable for dynamic scenarios.

Disadvantages:
This is limited to road sign detection. It would require substantial adaptation to extend the approach to accident detection or animal movement.
Scalability can be constrained in poor-resource environments. Focused basically on Taiwan road markings and it does not seem to readily apply to other locations.

6) Title: "Image Enhancement Technique Using YOLO Models for the Detection of Road Markings at Night" (First paper).
"System-Level Reliability Qualification of Complex Electronic Systems" (Second paper).

Author Name: Christine Dewi, Rung-Ching Chen, Yong-Cun Zhuang, William Eric Manongga (First paper).
D. Farley, A. Dasgupta, M. Al-Bassyiouni, J.W.C. de Vries (Second paper).

Year:

- 2024 (First paper).
- 2009 (Second paper).

What ideas or things can you use for your project from these papers:
- YOLO-based Real-Time Detection (First paper): Adapt YOLO models (e.g., YOLOv8) for real-time identification of vehicle movements, accidents, and road conditions.
- Image Enhancement Techniques (First paper): Apply CLAHE and other image enhancement methods for clear visibility in low-light conditions, improving accident detection.
- System Reliability Assessment (Second paper): Apply the "physics of failure" approach to ensure that the sensors and systems installed are robust and reliable under diverse environmental conditions.
- Data Acquisition (Second paper): Incorporate strain gauges and accelerometers to monitor sensor performance and ensure accuracy in vehicle movement detection.

Challenges:
- Hardware Deployment:
  Sensors placed on roads in an accurate manner to cover maximum area.
  Initial costs are high to install durable, high-quality sensors and wearable animal belts.
- Variability in Environment: Handling various weather and lighting conditions that may affect sensor performance.
- Data Processing: Real-time processing of large data streams from sensors and cameras.
- Animal Behavior Prediction: Developing effective alert mechanisms for wearable belts to avoid animals straying onto roads.

Overcome these challenges:
- Strategic Testing and Deployment: Pilot projects in controlled environments should be the starting point to ensure optimized sensor placement and performance.
- Robust Hardware Design: Use materials tested for durability against temperature fluctuations, vibrations, and mechanical stress, as suggested by the second paper.
- Algorithm Optimization: Use lightweight and efficient YOLO models to manage real-time detection tasks without compromising accuracy.
- Collaborations: Work with wildlife experts and veterinarians to design animal-friendly alert systems.

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What is the scope of these papers:
The first paper provides a framework for leveraging advanced AI models (YOLO) and image enhancement techniques for real-time road marking recognition, directly applicable to enhancing road safety technologies.
The second paper focuses on ensuring the reliability of electronic systems under operational stresses, ensuring robust implementation of the proposed roadside and wearable safety systems [5].

Advantages:
Real-time object detection with high precision (First paper).
System reliability enhanced by systematic testing and simulations (Second paper).
Techniques of image enhancement for visibility in poor lighting conditions (First paper).

Disadvantages:
Computational costs associated with processing the real-time YOLO model (First paper).
The high costs and complexity associated with the implementation of robust testing frameworks (Second paper).
Scalability of some techniques is bounded without large amounts of resources provisioned (Both papers).

3. PROBLEM STATEMENT

To Implement Road Safety Enhancement System by using Internet of Things (IoT) and Machine learning Algorithms.
Accidents on the road are a big problem, causing injuries, deaths, and financial struggles for people involved. They happen due to things like careless driving, bad road conditions, and weak traffic rules. These accidents also bring emotional pain to families and put a heavy load on hospitals and emergency services. To solve this, we need better ways to make roads safer, prevent accidents, and provide quick help when they happen. This can save lives and make traveling safer for everyone.

4. OBJECTIVES

- To reduce road accidents and increasing safety in case of occurrences.
- To enhance driving safety by following the traffic rules
- To maintain traffic flow smartly.
- To secure pedestrian or vulnerable user.
- To respond quickly in emergency accidents

5. PROPOSED SYSTEM

1) Intelligent Traffic Control: Responsive traffic lights, priority for emergency vehicles, and congestion updates.

- Adaptive traffic lights: These signals incorporate sensors and AI to time themselves according to real-time traffic flow to minimize congestion and maximize travel efficiency.
- Emergency vehicle prioritization: Systems will identify ambulances, fire trucks, or police cars and change the signals to clear their path and reach their destinations as fast as possible.
- Congestion notifications: Apps or on-street signage alert drivers about the presence of traffic jams; alternative routes are offered that can help avoid delays, causing less stress on particular roads.

2) Driver Monitoring: It includes systems for detection of drowsiness, speeding and alcohol impairment.

- Drowsiness detection: Sensors and cameras are provided in the vehicle to monitor driver activity, such as blinking rates or head movements, and issue warnings in case of signs of drowsiness.
- Speed violations: GPS and speed sensors track vehicle speed and alert drivers if they exceed limits. Authorities may also use automated systems to penalize offenders.
- Alcohol impairment detection: Breath sensors or touch-based alcohol detection systems in cars prevent ignition if the driver is intoxicated.

3) Improved Infrastructure: Smart Road sensors, digital signage, and pedestrian safety features.

- Smart road sensors: These sensors are embedded in roads, monitoring traffic density, road conditions, and vehicle speeds to provide data for better traffic management.
- Digital signage: Electronic displays show real-time updates, such as weather conditions, accidents ahead, or speed limits, keeping drivers informed.

Pedestrian safety features: Includes motion-sensor crosswalk lights, overpasses, underpasses, and tactile paths for visually impaired individuals to ensure safer walking zones.

4) Connected Vehicles: Vehicle-to-Infrastructure and Vehicle-to-Vehicle to avoid accidents.

- Vehicle-to-Vehicle, V2V: Cars, sharing information about speed, locations, and road conditions, share information to avoid collisions
- Vehicle-to-Infrastructure, V2I: vehicles interact with traffic signals and signs and other infrastructure by optimizing routes and warning of potential hazard, such as icy roads or a sharp curve.

5) Mobile Applications: Road hazard reporting, safety alerts and emergency assistance.

- Road hazard reporting: Apps enable users to report potholes, accidents, or debris on the roads, alerting other road users and authorities to take necessary action.
- Safety alerts: The system notifies drivers of possible hazards, such as sharp curves, animal crossings, or accidents ahead.
- Emergency assistance: In case of emergencies, users can quickly contact help with apps, providing emergency services with location details for immediate response

6) Surveillance: AI-powered cameras are used to detect violations and accidents.

- AI-powered cameras: Cameras that have AI can automatically capture traffic violations, such as running red lights or failure to wear seat belts.
- Accident detection: The cameras identify accidents in real-time and send an alert to emergency services immediately, which reduces response times.

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7) Data Analytics: Analysis of accidents to determine areas of high risk and predict hazards.

- High-risk zone identification: Accident data is analyzed in order to find the hotspots or accident-prone crossings or stretches of roads that deserve improvement, like improved lightings or extra signage
- Risk identification: Based on the characteristics of traffic, weather and road conditions, the likelihood of hazards can be pre-identified, and control measures can be undertaken.

8) Awareness Campaign: Public education about road safety.

9) Public education: Public campaigns through advertisement, videos, workshops, and social media to make people aware of the importance of obeying traffic rules and driving habits.

10) Focus areas: Dangers of speeding, drunken driving, and distracted driving and importance of seat belts and helmets.

9) Incentives: Rewarding good drivers and automated punishment of the offenders.

- Safe driving reward- the premium of the insurance discount is rewarded on a point scale
- Automatic Penalty by an AI system, Traffic camera enforces and imposes penalties consistently for every rule violation.

10) Emergency Integration- Alert about any accidents that may happen anytime, real-time assistance regarding medical needs.

- Real-time accident alerts: Systems immediately notify nearby drivers, emergency responders, and traffic managers about accidents, helping prevent secondary collisions and ensuring faster action.
- Medical assistance: Integration with healthcare services ensures ambulances are dispatched promptly.

6. ARCHITECTURE DIAGRAM

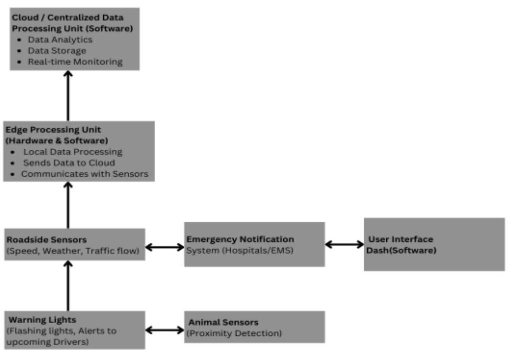

Fig 1: Architecture Diagram of RSES

7. DFD DIAGRAM

Component	Shape	Description
External Entities	Rounded Rectangle (Oval)	Represents sources/destinations of data
Processes	Rectangle	Represents the processing of data
Data Stores	Double Rectangle	Represents storage of data
Data Flows	Arrow	Represents data movement between entities/processes

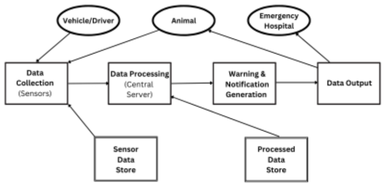

Fig 2 : Data Flow Diagram of RSES

8. UML DIAGRAM

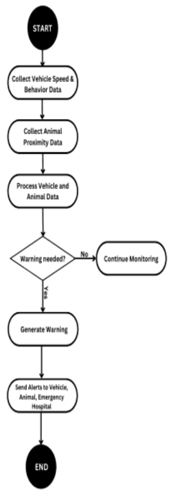

Fig 3 : UML Diagram of RSES

9. CONCLUSION

The Road Safety Enhancement System is all about building safe roads and reducing accident-related problems. It uses today's technology like real-time monitoring of traffic, intelligent smart alerts, and a glimpse of AI to foretell and prevent accidents that have not yet occurred in their path. It would thus allow the driver to become much better at making decisions concerning situations to avoid danger at that particular moment. The aim is to save lives, reduce injuries, and keep traffic running smoothly. Through improving and using this technology, we can make our roads safer for everyone.

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