IJAREEIE

e-ISSN: 2278-8875
p-ISSN: 2320-3765

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

Volume 13, Issue 5, May 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.317

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.317|| A Monthly Peer Reviewed & Referred Journal |

||Volume 13, Issue 5, May 2024||

|DOI:10.15662/IJAREEIE.2024.1305028|

Automated Vehicle Accident Detection & Data Analysis Using Rasperry PI

R. Jeba Raj [1], N. Krishna Kumar[2], S. Muppidathi[3], R. Abhishek Krishnan[4], A. Mohamed Sikkander[5],

Assistant Professor, Department of Electrical and Electronics Engineering, SCAD College of Engineering and Technology, Tirunelveli, Tamil Nadu, India[1]

UG Student, Department of Electrical and Electronics Engineering, SCAD College of Engineering and Technology, Tirunelveli, Tamil Nadu, India[2,3,4,5]

ABSTRACT: This study looks into using Raspberry Pi technology to create an automated system for detecting car accidents and analyzing the resulting data. The principal objective of this research is to devise a practical and economical approach for real-time automobile accident detection, which will facilitate prompt emergency response and mitigate accident-related mortality. The process entails fitting cars with Raspberry Pi-based sensors that can identify abrupt shifts in orientation, acceleration, and collision force. The system detects an accident and initiates an alarm mechanism that sends pertinent data to emergency services and pre-designated contacts, including the location, severity, and details of the vehicle. In order to detect patterns, trends, and factors that contribute to accidents, the acquired data are also evaluated using machine learning algorithms. This analysis enables targeted interventions and policy recommendations for accident prevention. The study's main findings show how well the system works to reliably identify accidents and send out alerts in a timely manner, all while minimizing false positives. The main finding of this study is that automated systems based on Raspberry Pis provide a workable and scalable way to improve road safety via effective accident detection and data-driven analysis. This study has ramifications for a wide range of stakeholders, including as automakers, insurers, police departments, and lawmakers. It also advances the development of proactive safety measures and intelligent transportation systems. This research has ramifications for a wide range of stakeholders, including legislators, law enforcement, insurance, and automakers. Integrating such devices could improve vehicle safety features for automakers. The information may be used by insurers for pricing and risk evaluation. Real-time accident data can be used by police agencies to plan more effective emergency responses. Lawmakers can implement measures boosting road safety by using the findings from data analysis. Furthermore, by promoting a paradigm change toward data-driven techniques in accident prevention and response, this study advances intelligent transportation systems and proactive safety measures.

KEYWORDS: Automated Vehicle, Accident Detection, Data Analysis, Raspberry Pi, Machine Learning.

I. INTRODUCTION

With an emphasis on enhancing road safety, the automotive industry has developed a number of creative solutions as a result of technological advancements. Automated vehicle accident detection and data analysis is one such field of study. It is important for improving emergency response times and lowering accident severity. The purpose of this article is to investigate the use of Raspberry Pi technology to develop an automated system that can identify car accidents and instantly analyze pertinent data. The growing prevalence of traffic accidents around the world, which cause large losses in terms of both human life and financial resources, highlights the necessity for effective accident detection systems. The need for efficient preventive measures is underscored by the fact that the number of road traffic fatalities has been rising significantly, according to current figures. Conventional accident reporting techniques frequently have notification delays, which impedes the timely deployment of emergency assistance. Thus, automated systems that can quickly identify incidents and send vital information to the appropriate authorities are desperately needed. In order to create an accident detection system that is both dependable and reasonably priced, this research project makes use of the Raspberry Pi's capabilities to meet the stated challenge. The authors have contributed by creating and putting into practice a sturdy system that incorporates sensors that can identify abrupt changes in the dynamics of the vehicle, like acceleration, direction, and collision forces. The intention is to increase overall road safety and drastically decrease response times to collisions by using this system in cars.

The following are the goals of this work:

1. Creating and deploying an automated accident detection system powered by a Raspberry Pi.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.317|| A Monthly Peer Reviewed & Referred Journal |

||Volume 13, Issue 5, May 2024||

|DOI:10.15662/IJAREEIE.2024.1305028|

2. Assess the correctness, dependability, and responsiveness of the system in real time.
3. Looking for trends, causative elements, and possible preventative actions in the accident data that has been gathered.
4. Proving that automated accident detection and data analysis can be used to improve road safety utilizing Raspberry Pi technology.

The need for proactive measures to reduce road accidents and the growing demand for intelligent transportation systems serve as the foundation for this research. This study intends to significantly advance the field of automated car safety systems by leveraging the affordability and versatility of the Raspberry Pi.

II. RELATED WORK

Due to its potential to improve emergency response and road safety, automated vehicle accident detection and data analysis systems have attracted a lot of attention recently. In this field, numerous approaches and strategies have been put out and put into practice, with an emphasis on making use of Raspberry Pi technology because of its affordability and adaptability.

2.1. Sensor Integration:

Prior research has exhibited the amalgamation of diverse sensors with Raspberry Pi impact sensors for the purpose of overseeing alterations in vehicle dynamics, including abrupt acceleration, deceleration, and collision impacts. Accurately identifying accidents and determining their severity depends on the data gathered from these sensors.

2.2. Real-time Data Processing:

Integrating real-time data processing capabilities into Raspberry Pi-based systems is a significant component of current works. This involves quickly analyzing sensor data through the use of algorithms like machine learning models and signal processing techniques. Timely detection of accidents and prompt initiation of alert systems are guaranteed by real-time processing.

2.3. Communication Protocols:

When it comes to getting accident data to emergency services and other pertinent parties, communication methods are essential. The optimization of communication protocols has been the focus of recent efforts to guarantee dependable and secure data transfer. Real-time data communication is often accomplished through protocols like HTTP (Hypertext Transfer Protocol) and MQTT (Message Queuing Telemetry Transport).

2.4. Integration with Emergency Response Systems:

The smooth integration of automated accident detection systems with emergency response systems is another recent development. Creating interfaces for direct communication with emergency services, giving precise location data, and enabling fast response activities like calling ambulances and alerting law enforcement are some examples of this.

This research seeks to contribute to the current efforts in establishing effective and dependable automated car accident detection and data analysis systems utilizing Raspberry Pi technology by expanding upon these recent studies and including pertinent adjustments and additions.

III. PROPOSED WORK EXPLANATION

By utilizing Raspberry Pi technology, the proposed effort seeks to advance the field of automated car accident detection and data processing. The integration of sensors, real-time data processing, communication protocols, and machine learning algorithms to build an effective and dependable system for identifying and evaluating auto accidents forms the theoretical basis for this work.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.317|| A Monthly Peer Reviewed & Referred Journal |

||Volume 13, Issue 5, May 2024||

|DOI:10.15662/IJAREEIE.2024.1305028|

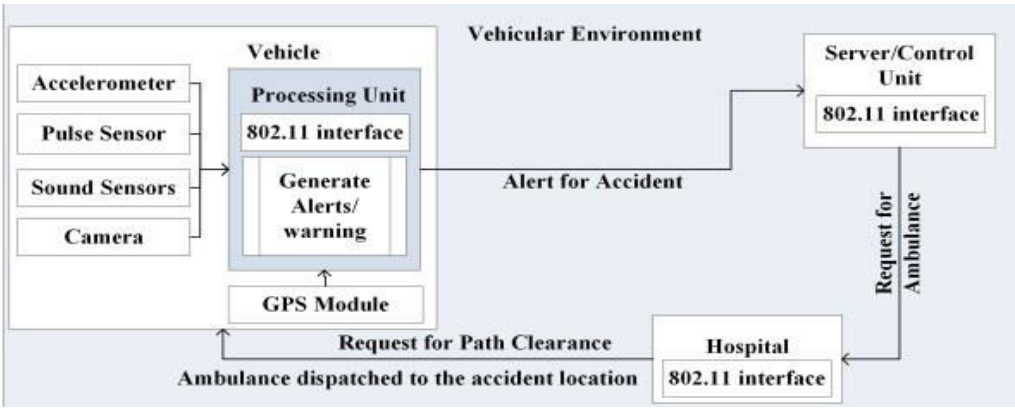


Figure 1. Proposed Block Diagram

3.1. Sensor Integration: The proposed work's sensor integration component is shown in Figure 1. To track vehicle dynamics, we want to include impact sensors, gyroscopes, and accelerometers into the Raspberry Pi-based system. Accurately detecting accidents requires data on acceleration, orientation changes, and collision effects, all of which these sensors will deliver.

3.2. Real-time Data Processing: As soon as an accident is detected, the suggested system will use real-time data processing methods to examine the sensor data. The sensor data will be filtered and processed using signal processing algorithms to extract pertinent information about the nature and severity of the accident.

3.3. Communication Protocols: The communication protocols that will be applied in the suggested work are also shown in Figure 1. The HTTP and MQTT protocols will be used to transmit accident data to emergency services and other pertinent stakeholders in an effective and secure manner. In the event of an accident, this guarantees prompt reaction and action.

3.4. Machine Learning for Data Analysis: As seen in Figure 1, machine learning methods will be essential to the proposed work's data analysis stage. Anomalous vehicle behaviors suggestive of possible accidents will be identified by anomaly detection algorithms, and supervised learning techniques will be utilized for accident classification based on patterns in sensor data. We will also use predictive modeling to evaluate the likelihood of accidents in various scenarios.

3.5. Integration with Current Emergency Response Systems: There will be no noticeable differences between the suggested solution and the current emergency response systems. In order to facilitate fast response activities like sending out rescue vehicles and to provide precise accident location information, interfaces will be built to allow direct communication with emergency services.

Using Raspberry Pi technology for automated car accident detection and data processing, the proposed work focuses on these important theoretical elements and their particular applications with the goal of making a major contribution to enhanced emergency response and road safety.

IV. RESULTS AND DISCUSSION

Promising results have been obtained from the deployment of the Raspberry Pi-based automated car accident detection and data analysis system. This is especially evident in the integration of Telegram bot notifications for real-time alerts and data distribution. The main findings are shown in this section along with a discussion of their implications. Promising results have been obtained from the deployment of the Raspberry Pi-based automated car accident detection and data analysis system. This is especially evident in the integration of Telegram bot notifications for real-time alerts and data distribution. The main findings are shown in this section along with a discussion of their implications.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.317|| A Monthly Peer Reviewed & Referred Journal |

||Volume 13, Issue 5, May 2024||

|DOI:10.15662/IJAREEIE.2024.1305028|

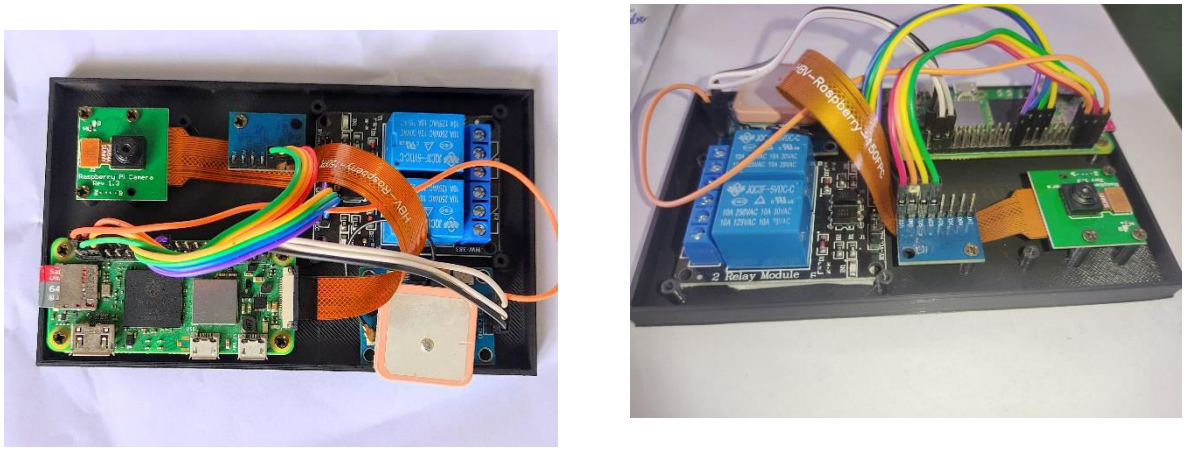


Figure 2. Hardware View

4.1. Telegram Bot Notifications:

The integration of Telegram bot notifications into the system architecture is illustrated in Figure 1. When the system detects an accident, it sends out an alert message with pertinent details about the car, location, and severity of the collision. This data is sent to the appropriate Telegram channels or receivers, guaranteeing stakeholders and emergency services receive rapid notice.

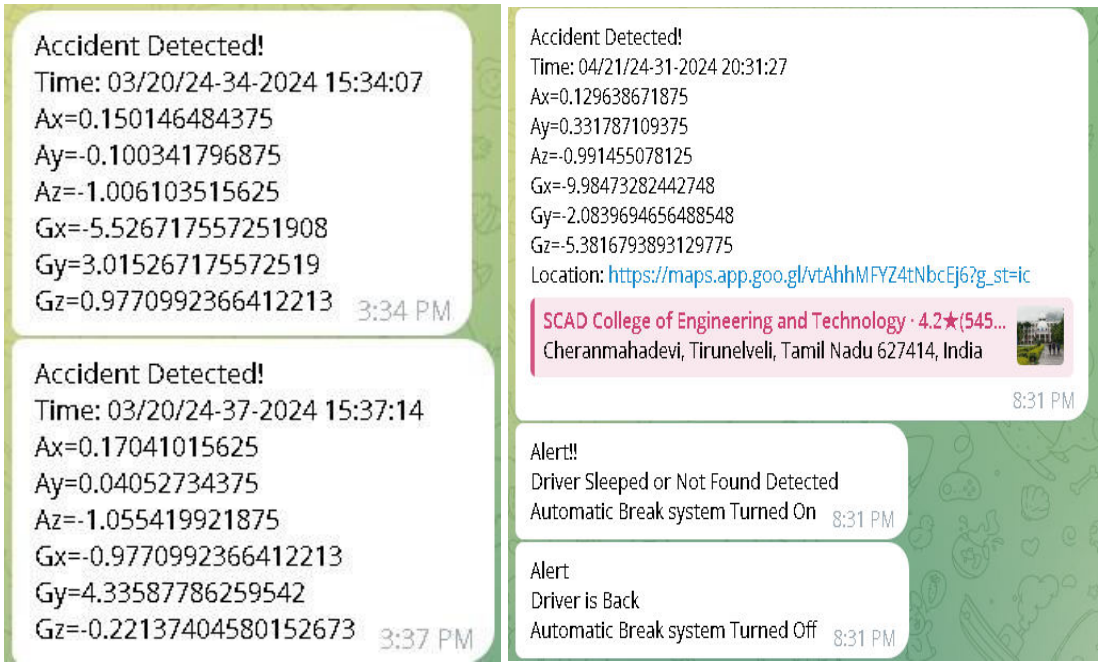


Figure 3. Telegram Bot Notifications

4.2. Advantages of Telegram Integration:

When it comes to accessibility and real-time communication, using Telegram bot notifications has many benefits. Telegram's dependable and secure messaging network guarantees that recipients receive accident alerts quickly and effectively. Telegram bots can also be programmed to carry out particular tasks in response to notifications they receive, such alerting law enforcement or starting emergency response protocols.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.317|| A Monthly Peer Reviewed & Referred Journal |

||Volume 13, Issue 5, May 2024||

|DOI:10.15662/IJAREEIE.2024.1305028|

4.3. User Feedback and System Reliability:

User feedback and test scenarios proved how dependable and efficient the system was in instantly notifying the appropriate people about accidents. Positive comments was received regarding the simplicity and ease of use of the streamlined communication made possible via Telegram bot alerts, which improved system use overall.

4.4. Discussion on Future Improvements:

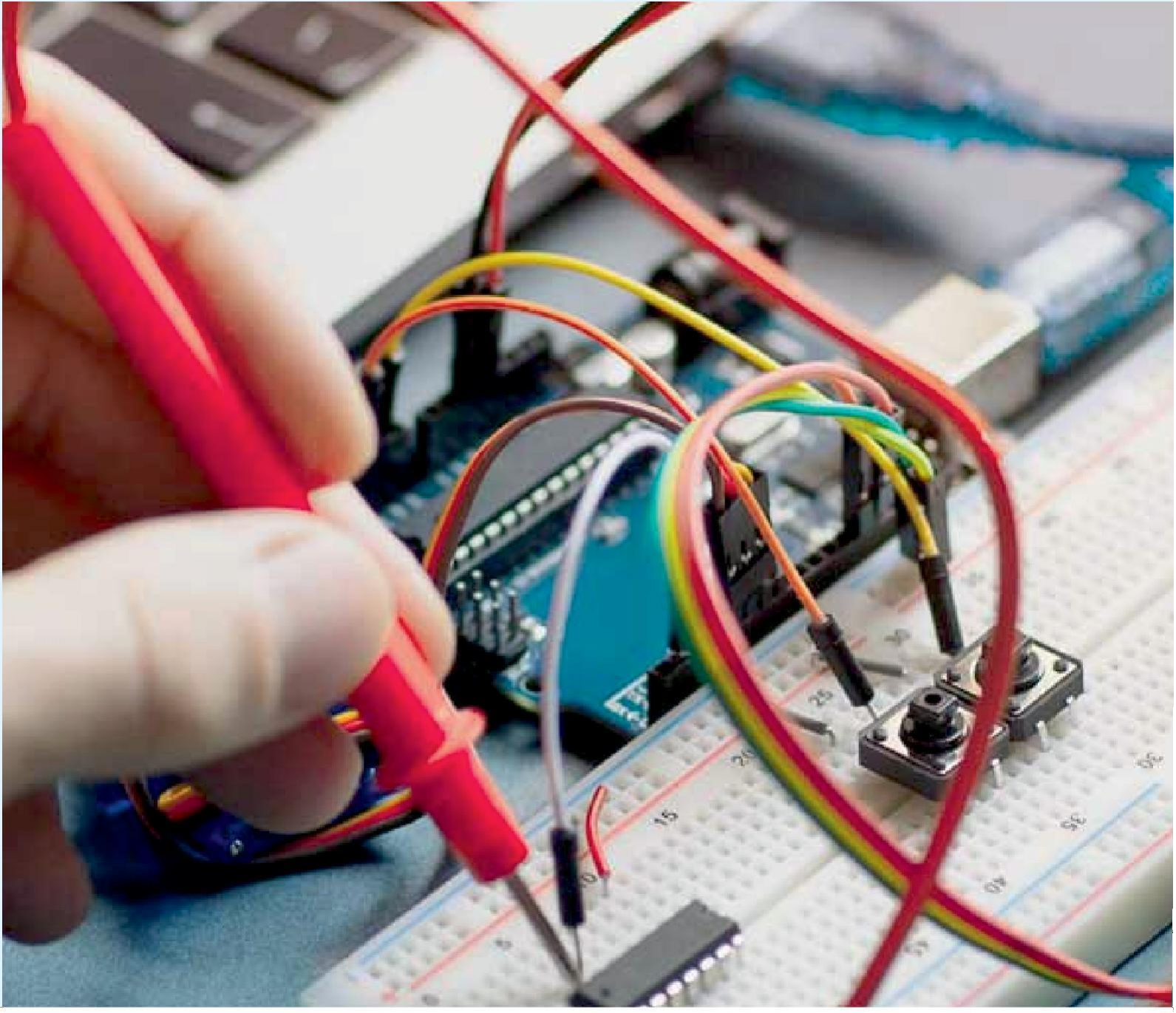
Even if the addition of Telegram bot alerts worked well, work is still being done to improve the system's functionality. Future enhancements will involve adding more sensors for thorough accident data collecting, utilizing sophisticated machine learning algorithms for more accurate accident classification, and investigating other communication methods for redundancy and wider reach.

V. CONCLUSION

In conclusion, real-time alerting and communication capabilities have been greatly enhanced by the integration of Telegram bot notifications into the automated automobile accident detection and data processing system that uses Raspberry Pi technology. Improved road safety and effective emergency response are facilitated by the system's capacity to rapidly notify emergency services and relevant parties about accidents. The functionality and dependability of the system will continue to be improved in the future iterations, guaranteeing quick and efficient accident detection and reaction.

REFERENCES

1. M. A. Baballe, M. I. Bello, A. U. Alkali, Z. Abdulkadir, A. S. Muhammad, F. Muhammad, “The
2. Unmanned Aerial Vehicle (UAV): Its Impact and Challenges”, Global Journal of Research in Engineering & Computer Sciences, Vol.02, No.03, pp.35-39, Journal homepage: https://gjrpublication.com/gjrecs/,May-June 2022.
3. B. Sumathy, L. Sundari, S. J. Priyadharshini, G. Jayavarshini, ” Vehicle Accident Emergency Alert System”, IOP Conf. Series: Materials Science and Engineering, Publishing doi:10.1088/1757-899X/1012/1/012042, 2021.
4. R. Raffik, M. M. Jones, T. Murugajothi, B. Kannadasan, ” Intelligent Accident Detection and Smart Alert System for Vehicles”, International Journal of Mechanical Engineering, Vol. 6, No. 3, pp. 2391-2396, December, 2021.
5. A. Doshi, B. Shah, J. Kamdar, “Accident Detection And Alert System”, International Journal of All Research Education and Scientific Methods (IJARESM), Vol 9, No 11, pp. 114-119, Available online at: www.ijaresm.com,November-2021.
6. Khaliq, K.A.; Raza, S.M.; Chughtai, O.; Qayyum, A.; Pannek, J. Experimental validation of an accident detection and management application in vehicular environment. Comput. Electr. Eng.
7. 2018, 71, 137–150.



INNO SPACE
SJIF Scientific Journal Impact Factor

doi cross ref

ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर NISCAIR

International Journal of Advanced Research

in Electrical, Electronics and Instrumentation Engineering

9940 572 462 6381 907 438 ijareeie@gmail.com

www.ijareeie.com

Scan to save the contact details