International Journal of Information Technology & Computer Engineering

ISSN 2347–3657

Volume 13, Issue 2s, 2025

Traffic Sign Recognition and Voice Alert System Using CNN for Intelligent Assistance

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ABSTRACT

Road signs are crucial for a safe and efficient traffic flow. Negligence in observing and misinterpreting traffic signboards is a key contributor to traffic accidents. The suggested technology aids in the recognition of traffic signs and provides the driver with a voice alarm via the speaker so that prompt decisions can be made. The system uses a Convolutional Neural Network (CNN) for traffic sign recognition and classification in addition to OpenCV for picture processing. To increase the accuracy of recognition, a set of traffic sign classes are established and trained. A voice alarm is produced and sent through a speaker to alert the driver when a traffic sign is detected. To help the driver keep informed of the regulations to follow along the road, the device also has a feature that notifies them of any nearby traffic signs. By reducing human error in traffic sign reading, this technology aims to improve the safety of drivers, passengers, and pedestrians.

1. INTRODUCTION

The location and recognition of traffic signs are crucial for providing security for all street customers. Recently, a number of computer vision frameworks have been developed for the analysis of traffic signs. However, the features of current computations (precision of acknowledgement, false caution rate, and resistance to air changes) are still insufficient to replace a human operator. In 2002, road accidents killed 1.2 million people globally, accounting for 2.1% of all fatalities and ranking as the 11th leading cause of death [1]. We are currently approaching an underused era where crashes are rare or perhaps typical due to advancements. In actuality, the automotive industry has used new Brilliantly Transport Frameworks (ITS) to make driving safe and convenient while also saving money and lives. Innovative advancements have been made, and vehicles with auto-pilot have been introduced. Independent automobiles are now a reality. The market for self-driving cars has expanded rapidly. However, these features are essentially available in a select few luxury vehicles that are beyond of reach for the majority of people. We had to design a framework that would help to some degree to make driving easier. After doing a survey, we discovered that India had a startlingly high number of roadway accidents. According to reports, there are over 53 disasters that occur on the highways every hour. Additionally, these events cause more than 16 deaths every hour. When someone drives without paying attention to traffic signs, they endanger not just their own life but also the lives of other vehicles, passengers, and bystanders. As a result, we developed this technology, which uses the live video stream to automatically identify traffic signs and read them aloud to the driver, who can then make the appropriate decision. The idea of using GPS to determine the client's location is another range center in our system. Additionally, every traffic sign will be stored in a database along with its location, allowing drivers to be alerted in advance of another approaching traffic sign.

In order to control traffic safety, direct drivers, and maintain a smooth vehicle flow, traffic signs are essential. However, ignoring or misinterpreting traffic signs—particularly when driving at high speeds or in low visibility—is one of the main causes of traffic accidents. Automated traffic sign identification has become a viable way to help drivers recognize and react appropriately to road signs because to developments in deep learning and artificial intelligence. Convolutional Neural Networks (CNNs)

DOI: https://doi.org/10.62647/IJITCE2025V13I2sPP59-66

International Journal of Information Technology & Computer Engineering
ISSN 2347–3657
Volume 13, Issue 2s, 2025

are used in this project's deep learning-based traffic sign identification system to identify and categorize traffic signs in real time. The system is intended to record and examine photos of traffic signs from live camera feeds, evaluate them using a CNN model that has already been trained, and provide drivers immediate audio notifications. Utilizing the German Traffic Sign Benchmark Dataset, which has more than 51,900 photos and 43 distinct categories, the model is trained to accurately identify a broad range of traffic signs. By providing real-time support, the system's main goal is to increase driver awareness and lower accident rates. This automated approach guarantees quicker and more accurate sign recognition, especially under difficult environmental conditions, in contrast to conventional traffic sign detection techniques that depend on human observation. By reducing distractions and enabling drivers to concentrate on the road, voice alert integration further streamlines the driving experience. To enhance traffic control and road safety, this technology can be used in advanced driver-assistance systems (ADAS), smart cars, and autonomous driving applications.

This is how the remainder of the article is structured: A brief survey of relevant studies is given in Section 2. The preliminary findings are presented in Section 3. Section 4 discusses the primary algorithm and system design. Additionally, the blockchain-based IA paradigm is introduced in Section 5. The main conclusions and experimental results are presented in Section 6. Lastly, our work is summarized in Section 7.

2. LITERATURE SURVEY

Title: Indian Traffic Sign Board Recognition and Driver Alert System Using Machine Learning
Author: Yadav, Shubham & Patwa, Anuj & Rane, Saiprasad & Narvekar, Chhaya
Year: 2022
Description: Sign board recognition and driver alert system which has a number of important application areas that include advance driver assistance systems, road surveying and autonomous vehicles. This system uses image processing technique to isolate relevant data which is captured from the real time streaming video. The proposed method is broadly divided in five part data collection, data processing, data classification, training and testing. System uses variety of image processing techniques to enhance the image quality and to remove non-informational pixel, and detecting edges. Feature extracter are used to find the features of image. Machine learning algorithm Support Vector Machine (SVM) is used to classify the images based on their features. If features of sign that are captured from the video matches with the trained traffic signs then it will generate the voice signal to alert the driver. In India there are different traffic sign board and they are classified into three categories: Regulatory sign, Cautionary sign, informational sign. These Indian signs have four different shapes and eight different colors. The proposed system is trained for ten different types of sign. In each category more than a thousand sample images are used to train the network.

Title: Automatic Signboard Detection System by the Vehicles
Author: Anushree.A., S., Kumar, H., Iram, I., & Divyam, K
Year: 2020.
Description: A major cause of accidents is not considering the signboards on roads, and not following the rules accordingly. So to avoid this problem, introducing a signboard detection system in the vehicle which will detect the signboard and warn the driver about it. It displays the alert message or information on provided LCD and voice alert through speakers. Traffic sign recognition is important to transport system on the highway or road. Major approach is to detect road sign and extract it using openCV. The system will play an important role in saving many life.

Title: A smart driver alert system for vehicle traffic using image detection and recognition technique
Author: S. Harini, V. Abhiram, R. Hegde, B. D. D. Samarth, S. A. Shreyas and K. H. Gowranga **Year:** 2021.
Description: Road signs are important to ensure smooth traffic flow without bottle necks or mishaps. Road symbols are the pictorial representations having different necessary information required to be understood by driver. Road signs in front of the vehicle are ignored by the drivers and this can lead to catastrophic accidents. This paper presents an overview of the traffic sign board detection and recognition and implements a procedure to extract the road sign from a natural complex image, processes it and alerts the driver using voice command It is implemented in such a way that it acts as a boon to drivers to make easy decisions.

Title: Research and Application of Traffic Sign Detection and Recognition Based on Deep Learning
Author: C. Wang
Year: 2018
Description: Nowadays, with the rapid development of society and economy, automobiles have become almost one of the convenient modes of transport for every household. This makes the road traffic environment more and more complicated, and people

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International Journal of Information Technology & Computer Engineering
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Volume 13, Issue 2s, 2025

expect to have an intelligent Vision-assisted applications that provide drivers with traffic sign information, regulate driver operations, or assist in vehicle control to ensure road safety. As one of the more important functions, traffic sign detection and recognition[1], has become a hot research direction of researchers at home and abroad. It is mainly the use of vehicle cameras to capture real-time road images, and then to detect and identify the traffic signs encountered on the road, thus providing accurate information to the driving system. However, the road conditions in the actual scene are very complicated. After many years of hard work, researchers have not yet made the recognition system practical, and further research and improvement are still needed. Traditionally, traffic signage has been detected and categorized using standard computer vision methods, but it also takes considerable time to manually process important features of the image. With the development and progress of science and technology, more and more scholars use deep learning technology to solve this problem. The main reason that the deep learning method is widely accepted is that the model can learn the deep features inside the image autonomously from the training samples, especially for many cases that do not know how to design the feature extractor, such as expression recognition, target detection Wait. Based on the application of road traffic sign detection and recognition, this article focuses on the correctness and high efficiency of detection and recognition. Through Caffe which is the open-source framework, a deep convolution neural network algorithm is proposed to train traffic sign training sets to get a model that can classify traffic signs and to learn and identify the most critical of these traffic signs Features, so as to achieve the purpose of identifying traffic signs in the real scene.

Title: VSSA-NET: Vertical Spatial Sequence Attention Network for Traffic Sign Detection
Author: Y. Yuan, Z. Xiong and Q. Wang
Year: 2019**.**

Description: Although traffic sign detection has been studied for years and great progress has been made with the rise of deep learning technique, there are still many problems remaining to be addressed. For complicated real-world traffic scenes, there are two main challenges. First, traffic signs are usually small-sized objects, which makes them more difficult to detect than large ones; second, it is hard to distinguish false targets which resemble real traffic signs in complex street scenes without context information. To handle these problems, we propose a novel end-to-end deep learning method for traffic sign detection in complex environments. Our contributions are as we propose a multi-resolution feature fusion network architecture which exploits densely connected deconvolution layers with skip connections, and can learn more effective features for a small-size object and we frame the traffic sign detection as a spatial sequence classification and regression task, and propose a vertical spatial sequence attention module to gain more context information for better detection performance. To comprehensively evaluate the proposed method, we experiment on several traffic sign datasets as well as the general object detection dataset, and the results have shown the effectiveness of our proposed method.

3. RELATED WORK

People typically fail to recognize traffic signs in this fast-paced era, which leads to them breaking the law. In an effort to lower the amount of mishaps, a portion of the inquiry has been eliminated. To categorize the traffic signs and warn the driver, analysts have used a variety of CNN models and classification algorithms. Our solution aims to maximize the acknowledgment technique while also providing additional advantages, such early warning to the driver. Numerous research have tried a variety of methods to determine the location of traffic signs.

[1] The Bolster Vector Machine approach is used in one of the forms. The dataset uses straight classification and was split into 90/10 for testing and preparation. A series of steps known as Color Division, Shape Classification, and Acknowledgment were implemented in order to attain the desired outcome. With far less coding, the Raspberry Pi is used to identify and recognize traffic signs [2]. However, in order to use it, one must have a Raspberry Pi board, which is somewhat expensive. Taking pictures seriously is another method of acknowledging traffic signs [3]. An outline of a video is obtained and dissected. Isolating the front and foundation, reducing, and differentiating the image are all part of the pre-processing process. Following these activities, the signs are classified as round, triangular, or hexagonal in shape and sent for template matching. The pretrained algorithm coordinates the objects with a few positive forms. An open-source framework called

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International Journal of Information Technology & Computer Engineering

ISSN 2347–3657

Volume 13, Issue 2s, 2025

Caffe helps people recognize and interpret street traffic signs with great precision and efficiency [4]. To create training sets for traffic signs and obtain a demonstration that can classify traffic signs, a CNN method is suggested.

Another strategy for utilizing the CNN conspire is proposed in [11], in which the real border of the objective sign is evaluated by projecting the boundary of a comparing format sign picture into the input picture plane. When we transform the boundary estimation problem into a posture and shape expectation work based on CNN, the approach advances to become end-to-end trainable. Compared to other boundary assessment techniques that rely on contour estimate or image segmentation, it is safer to obstruct and limit aims.suggests a multi-resolution combination arrange engineering method for sign finding that helps separate different little things from sign sheets. For better detection, more setting data can also be assembled using a vertical spatial sequence attention (VSSA) module. Mobile apps include Expanded Reality innovation through GPS-based tracking [5]. It uses the capabilities of an auser's smartphone as a guide to assist users in quickly and dynamically locating potential assets depending on the user's camera's field of vision.

The CNN Alex Net structure, which has eight levels in its construction, is used in [7]. Convolutional layers make up the first five layers, whereas the latter three are all associated layers. It turns out that this design is 92.63% accurate. Additionally, the Google Net design is used in [7], which is important for dealing with large amounts of data and numerous factors. Its drawback is that the large amount of data leads to organize overfitting, which reduces accuracy to about 80.5%. In [8], VGG CNN is suggested, and it performs fundamentally better than other available designs. This method significantly reduces the amount of parameters in order to improve and expedite the computation. The network also includes the Crevice (global normal pooling) and BN (clump standardization) layers, which help to increase precision without adding more parameters. However, we found in [10] that we can combine the advanced architecture of Faster-RCNN with Online Difficult Examples Mining (OHEM) by deleting the pool4 layer of VGG16 and using expansion for ResNet. This makes the framework more adaptable and aids in the identification of small traffic signs.

4. METHODOLOGIES

Word classification indicates that a sign has been assigned to a certain class based on features, whereas word recognition generally indicates that a sign has been identified. In this chapter, both terms are used interchangeably because recognition may frequently entail classification [18–20]. Road and traffic signs can be identified and categorized using a variety of methods, including:

- Collecting dataset,
- Image pre-processing,
- Train CNN,
- Deploy CNN to detect traffic signs.

DESIGN APPROACH:

CNN, or neural network with convolution, is used in voice notification devices for traffic sign detection. With this method, the system will be divided into numerous modules or functions, each of which will be in charge of carrying out a certain duty. It is much simpler to study and consider designing each component independently when the system is divided into these functions or a module. This method facilitates code group improvement, modular development, and scalability and flexibility in the development or replacement of individual signal functions as needed [13–17].

DETAIL DESIGN:

The innovative approach of using neural networks with convolution (CNN) for functional traffic sign detection with voice notification devices:

Training Data Dataset: The CNN model must be trained using a sizable dataset of traffic visual signs. A wide range of signs for different traffic types, lighting circumstances, and backdrops should be included in the dataset.

Labels: Each image in the training dataset needs to be labeled with the corresponding traffic sign group for supervised learning. The labels should indicate the different types of traffic signs that are featured at the time image.

VALIDATION DATA:

Dataset: The trained CNN model must be evaluated using a different dataset. Any traffic sign photos that the subject was not present during training should be included in this dataset, which should be separate from the training dataset.

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International Journal of Information Technology & Computer Engineering

ISSN 2347–3657

Volume 13, Issue 2s, 2025

Labels: Similar to the training dataset, labeled images are needed for the validation dataset in order to assess the CNN model's accuracy and performance.

Image frames: A camera installed on the car must provide a constant video stream for the system to function. In order to identify and detect traffic signs, one of the video stream's frames is analyzed.

Frame resolution: The video frames from the camera should have enough resolution to show the traffic signals.

4. OUR PROPOSED MODEL

Convolutional Neural Arrange (CNN):

CNN is one of the most well-known and frequently used deep neural networks when it comes to deep learning. NNs were first developed and used in the 1980s. The majority of networks at the time could recognize handwritten digits. In the postal industry, it was widely used to read postal codes, important values, and other related information. The most important thing to understand about any deep learning algorithm is that it requires a lot of computer power and a lot of data to train. It was a major flaw in CNN's algorithms. They were limited to the postal industry at the time and never forced products into the artificial intelligence (AI) space.

Understanding the fundamentals, such as what an image is and how it is represented, is necessary to fully understand how a CNN model operates. In contrast to an RGB image, which is nothing more than an array of values for pixels with three planes, a grayscale image is only an array of values for pixels with one plane.

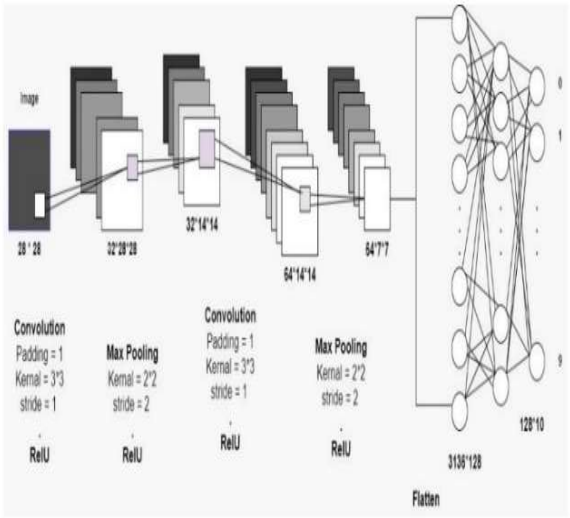

Figure 1. Architecture of CNN.

Figure 1 depicts CNN's architecture. Similar to how a neuron in the brain processes and distributes information throughout the body, artificial neurons, or nodes in CNNs, take inputs, process them, and then send the outcome as output. A typical neural network consists of an input layer, hidden layers, and an output layer. The structural architecture of the brain served as the model for CNNs. CNNs may have numerous hidden layers, but only one of them is capable of removing a picture via passing calculations. Examples of this include fully connected layers, cured linear units, pooling, and convolution. The fundamental layer that extracts features from an input image is called convolution. The input layering in the form of arrays is provided by these image pixels.

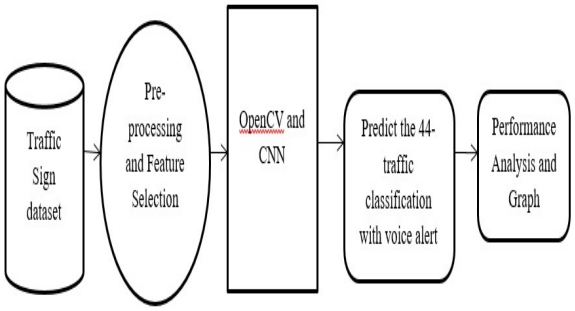

Figure 2. Traffic sign detection.

5. RESULT

The trained neural network which contains 4 convolution layers and 2 max pooling layers along with dropout, flatten and dense layers proved to give a better result as compared to the other CNN Architectures. The accuracy of the trained networkis 95%.

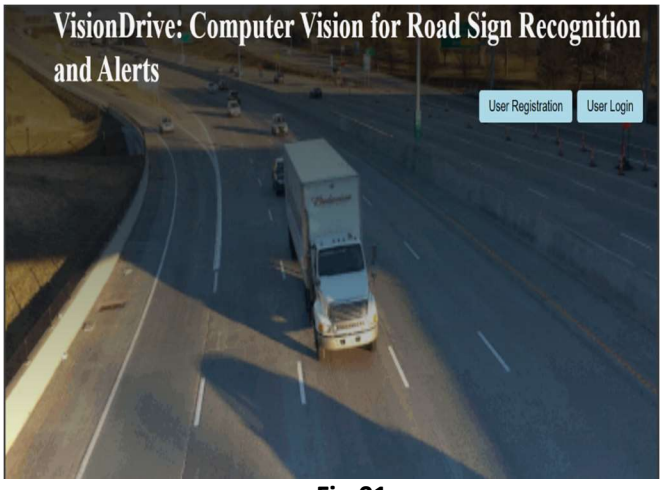

Fig:01

DOI: https://doi.org/10.62647/IJITCE2025V13I2sPP59-66

International Journal of Information Technology & Computer Engineering

ISSN 2347–3657

Volume 13, Issue 2s, 2025

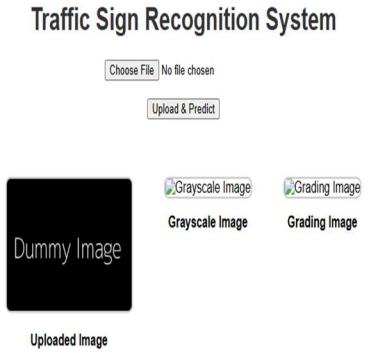

Fig:02

Fig:03

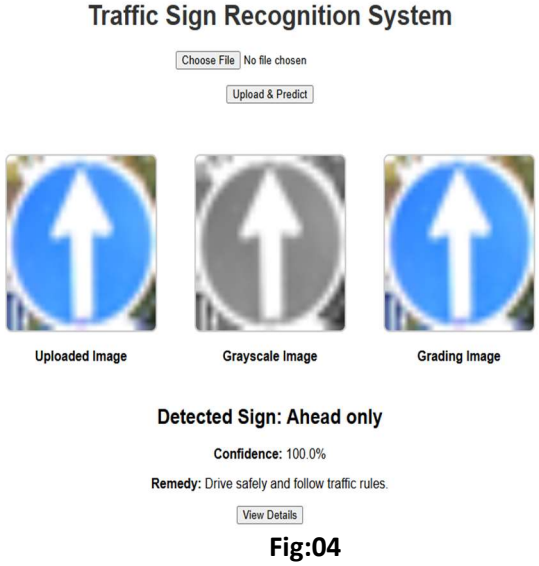

Fig:04

6. CONCLUSION AND FUTURE ENHANCEMENT

Convolutional neural networks are used in the implementation of the Traffic Sign Board Detection and Voice Alert System. After examining several models under the CNN umbrella, the model with the best accuracy on the GTSRB dataset was put into use. The model's accuracy has increased thanks to the development of distinct classes for every traffic sign. After the sign is recognized, an audio message is provided to the driver, alerting them and assisting them in making the right judgments. Since it would make driving easier without sacrificing safety, this article represents a significant achievement in the realm of driving. Additionally, this system is simple to set up and requires little hardware, which expands its application.

An integrated alert system with a camera in the middle of the car might be added to the prototype. Additionally, a function that provides an expected time of arrival at that specific traffic light could be implemented. This system can also be extended to recognize traffic signals and notify the user of the signal's condition and estimated time of arrival. By planning their trip start time appropriately, the user can cross all signals without having to wait. Additionally, an API that provides the license holder's details and license number will be used to verify the driver.

7. REFERENCES

[1]. V. Ciuntu and H. Ferdowsi, "Real-Time Traffic Sign Detection and Classification Using Machine Learning and Optical Character Recognition," 2020 IEEE International Conference on Electro Information Technology (EIT), 2020, pp. 480- 486, doi:10.1109/EIT48999.2020.9208309.

[2]. M. T. Islam, "Traffic sign detection and recognition based on convolutional neural networks," 2019 International Conference on Advances in Computing, Communication and Control (ICAC3), 2019, pp. 1-6, doi: 10.1109/ICAC347590.2019.9036784.

[3]. Yadav, Shubham & Patwa, Anuj & Rane, Saiprasad & Narvekar, Chhaya.(2019). Indian Traffic Sign Board Recognition and Driver Alert System Using Machine Learning. International Journal of Applied Sciences and Smart Technologies. 1. 1-10. 10.24071/ijasst.v1i1.1843.

[4]. Anushree.A., S., Kumar, H., Iram, I., & Divyam, K. (2019). Automatic Signboard Detection System by the Vehicles.

DOI: https://doi.org/10.62647/IJITCE2025V13I2sPP59-66

[5]. S. Harini, V. Abhiram, R. Hegde, B. D. D. Samarth, S. A. Shreyas and
[6]. K. H. Gowranga, "A smart driver alert system for vehicle traffic using image detection and recognition technique," 2017 2nd IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT), Bangalore, India,2017,pp.15401543,doi:10.1109/RTEICT.2017. 8256856.
[7]. C. Wang, "Research and Application of Traffic Sign Detection and Recognition Based on Deep Learning," 2018 International Conference on Robots & Intelligent System (ICRIS), Changsha, China, 2018, pp. 150- 152, doi: 10.1109/ICRIS.2018.00047.
[8]. M A Muchtar et al 2017 J. Phys.: Conf. Ser. 801 012010
[9]. Y. Yuan, Z. Xiong and Q. Wang, "VSSA-NET: Vertical Spatial Sequence Attention Network for Traffic Sign Detection," in IEEE Transactions on Image Processing, vol. 28, no. 7, pp. 3423-3434, July2019, doi: 10.1109/TIP.2019.2896952.
[10]. S. Huang, H. Lin and C. Chang, "An in-car camera system for traffic sign detection and recognition," 2017 Joint 17th World Congress of International Fuzzy Systems Association and 9th International Conference on Soft Computing and Intelligent Systems (IFSASCIS),Otsu, Japan, 2017, pp. 1-6, doi: 10.1109/IFSA- SCIS.2017.8023239.
[11]. Bi, Z., Yu, L., Gao, H. et al. Improved VGG model-based efficient traffic sign recognition for safe driving in 5G scenarios. Int. J. Mach. Learn. & Cyber. (2020).
[12]. Chuanwei Zhang et al., Study on Traffic Sign Recognition by Optimized Lenet-5 Algorithm, International Journal of Pattern Recognition and Artificial Intelligence, doi:0.1142/S0218001420550034
[13]. Han, C., Gao, G. & Zhang, Y. Real-time small traffic sign detection with revised faster-RCNN. Multimed Tools Appl78,13263–13278(2019).
[14]. H. S. Lee and K. Kim, "Simultaneous Traffic Sign Detection and Boundary Estimation Using Convolutional Neural Network," in IEEE Transactions on Intelligent Transportation Systems, vol. 19, no. 5, pp.1652-1663, May 2018, doi: 10.1109/TITS.2018.2801560.
[15]. R. Qian, Y. Yue, F. Coenen and B. Zhang, "Traffic sign recognition with convolutional neural network based on max pooling positions,"2016 12th International Conference on Natural Computation, Fuzzy Systems and Knowledge Discovery (ICNC-FSKD), Changsha, China, 2016, pp. 578- 582, doi: 10.1109/FSKD.2016.7603237.
[16]. A. Pon, O. Adrienko, A. Harakeh and S. L. Waslander, "A Hierarchical Deep Architecture and Mini-batch Selection Method for Joint Traffic Sign and Light Detection," 2018 15th Conference on Computer and Robot Vision (CRV), Toronto, ON, Canada, 2018, pp. 102-109,doi:10.1109/CRV.2018.00024.
[17]. Saha S., Islam M.S., Khaled M.A.B., Tairin S. (2019) An Efficient Traffic Sign Recognition Approach Using a Novel Deep Neural Network Selection Architecture. In: Abraham A., Dutta P., Mandal J., Bhattacharya A., Dutta S. (eds) Emerging Technologies in Data Mining and Information Security. Advances in Intelligent Systems and Computing, vol 814. Springer, Singapore. https://doi.org/10.1007/978-981-13-1501- 5_74
[18]. A. Welzel, A. Auerswald and G. Wanielik, & quot; Accurate camera- based traffic sign localization," 17th International IEEE Conference on Intelligent Transportation Systems (ITSC), Qingdao, China, 2014, pp. 445-450, doi: 10.1109/ITSC.2014.6957730.
[19]. M. Karaduman and H. Eren, & quot;Deep learning based traffic direction sign detection and determining driving style," 2017 International Conference on Computer Science and Engineering (UBMK), Antalya, Turkey, 2017, pp. 1046-1050, doi:10.1109/UBMK.2017.8093453.
[20]. E. Winarno, W. Hadikurniawati and R. N. Rosso, & quot; Location basedservice for presence system using haversine method," 2017 International Conference on Innovative and Creative Information Technology (ICITech), Salatiga, Indonesia, 2017, pp. 1-4, doi:10.1109/INNOCIT.2017.8319153.
[21]. Pal R, Ghosh A, Kumar R, et al. Public health crisis of road traffic accidents in India:Risk factor [22]. assessment and recommendations on prevention on the behalf of the Academy of Family Physicians of India. J Family Med Prim Care. 2019;8(3):775-783. doi:10.4103/jfmpc.jfmpc_214_18

[22] Mohammed Abdul Bari, Shahanawaj Ahamad, Mohammed Rahmat Ali," Smartphone Security and Protection Practices", International Journal of Engineering and Applied Computer Science (IJEACS) ; ISBN: 9798799755577 Volume: 03, Issue: 01, December 2021 (International Journal,U K) Pages 1-6

[23] M.A.Bari, Sunjay Kalkal, Shahanawaj Ahamad," A Comparative Study and Performance Analysis of Routing Algorithms", in 3rd International Conference ICCIDM, Springer - 978- 981-10-3874-7_3 Dec (2016) ; Impact Factor :4.18

DOI: https://doi.org/10.62647/IJITCE2025V13I2sPP59-66

International Journal of Information Technology & Computer Engineering

ISSN 2347–3657

Volume 13, Issue 2s, 2025

[24] Mohammed Shoeb, Mohammed Akram Ali, Mohammed Shadeel, Dr. Mohammed Abdul Bari, "Self-Driving Car: Using Opencv2 and Machine Learning", The International journal of analytical and experimental modal analysis (IJAEMA), ISSN NO: 0886-9367, Volume XIV, Issue V, May/2022

DOI: https://doi.org/10.62647/IJITCE2025V13I2sPP59-66