iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 Issue: VIII Month of publication: Aug 2023

DOI: https://doi.org/10.22214/ijraset.2023.55153

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VIII Aug 2023- Available at www.ijraset.com

Intelligent Traffic Control System using Deep Reinforcement Learning

K. Akhilandeswari Devi [1], K. Chinnanagaraju [2], V. Anil Santosh [3] D D D Suribabu [4]
[1]M-Tech student Department of Computer Science and Engineering, International School of Technology and Sciences (For Women), Andhra Pradesh, India
[2]Assistant Professor Department of Computer Science and Engineering, International School of Technology and Sciences (For Women), Andhra Pradesh, India
[3]Associate Professor Department of Computer Science and Engineering, International School of Technology and Sciences (For Women), Andhra Pradesh, India
[4]Associate Professor & Head Department of Computer Science and Engineering, International School of Technology and Sciences (For Women), Andhra Pradesh, India

Abstract: Road Traffic signals are placed in particular positions to make sure the protection of vacationers. In this paper, we proposed a device for site visitors signal detection and recognition, in addition to a technique for extracting an avenue signal from an herbal complicated photo for processing and alerting the driving force via voice command. The reliability of the device is increased through different aspects such as noise, partial or absolute underexposure, partial or whole overexposure, considerable versions in shadeation saturation, extensive sort of viewing angles, view depth, and shape/shadeation deformations of site visitors symptoms etc. The proposed structure is sectioned into three phases. The first of that is photo pre-processing, where the dataset`s enter files are quantified, which decides the enter length for getting to know purposes, and resizes the records for the getting to know step. A Convolutional Neural Network (CNN) is used to train within the segment side which further more offers the text-to-speech translation, with the detected signal from the second one segment being supplied in audio format, which demonstrates better accuracy.
Keywords: Convolutional Neural Network (CNN), German Traffic Sign Recognition (GTSR), Google Net, Text-to-speech translation, Traffic signs.

I. INTRODUCTION

One of the most crucial components of autonomous cars and advanced driver assistance systems (ADAS) is the classification of traffic signs [8],[9],[10]. The majority of the time, drivers ignored traffic signs because of various stoplights, traffic lights, or traffic signals are signalling devices used at road junctions, pedestrian crossings, and other sites to manage traffic flows. In South Africa, they are sometimes referred to as robots [1], [2]. Traffic lights typically include three signals, which communicate important information to automobiles and cyclists using various colours and symbols, such as bicycles and arrows. Red, yellow, and green are the standard traffic light colours, and they are often positioned vertically or horizontally in that sequence [3]. Despite being globally standardized [4] there are differences in traffic light legislation and sequences at the national and municipal levels. On Parliament Square in London, the technique was first used in December 1868 to lessen the need for police officers to regulate traffic [5]. Accidents might be decreased by automating the categorization of traffic indicators. Traffic sign classification techniques based on traditional computer vision and machine learning were widely utilised, however deep learning based classifiers quickly supplanted to previous techniques. In the categorization of traffic signs, deep convolutional networks recently outperformed conventional techniques. Given the quick development of deep learning algorithmic structures and the viability of implementing them in a high-performance manner using graphics processing units (GPU), Re-examining the categorization issues with traffic signs from the standpoint of effective deep learning is beneficial. The classification of traffic signs is not an easy process; pictures are adversely affected by variations in lighting, orientation, and vehicle speeds, among other factors. A wide-angle camera is typically positioned on top of a car to record traffic signs and other relevant visual elements for ADAS. The speed of the automobiles, the sun, the rain, and other environmental conditions all cause distortion in these photographs. In Fig. 1, some photos from the GTSRB dataset are displayed.

Fig 1: Data set of GTSRB

In this study, we have built a novel system for classification on top of deep learning techniques. Our goal is to address the customary manual data augmentation. The system needs to learn the problem and how to reduce a large number of parameters, less calculations memory will be required with the lowering of some parameters. We would utilise numerous sized filters and concatenate their convolutional filter responses to obtain more abstract representations in a single layer as opposed to utilising a single sized filter for one convolutional layer.

II. METHODS

Changes in rotation, translation, and contrast have an impact on how traffic signals are classified. By applying several transformations to the input picture, it is feasible to cancel out the effects of spatial changes in an image brought by vehicle cameras due to variable speed. However, these manually created changes don't always work and depend on the situation. In this study, modified versions of Google Neural Network and a spatial transformer network [2] are utilized for automatically alter the input pictures to increase classification accuracy and robustness. Changes in rotation, translation, and contrast have an impact on how traffic signals are classified.

A. *Invariant of Transformation*

A moving camera causes several types of picture distortion, including blurring, translational distortion, rotational distortion, scale distortion, and skew. For classification, layers of spatial transformers would be applied to the feature map (which includes the input picture batch). Since the modules for spatial transformations can be differentiated hence the back propagation technique may be used to train with them. Three components make up spatial transformer layers: the sample unit, the grid generator, and the localization network. The spatial transformer network and its parts are depicted in Figure 2. This layer might be added to the CNN network at any time, and it is effective to handle because of its transformer Layer. For high computational efficiency by utilising this layer with CNN, manual data augmentation techniques like translation and rotation were avoided, and the network was able to learn active features map modification. A last essential regression layer to create parameters must be present in the localization network, which can be fully connected or a convolutional neural network.

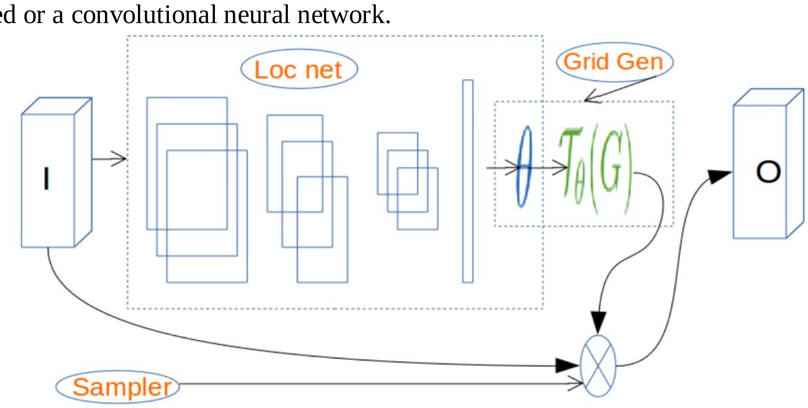


Fig 2: Transformer Layer

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VIII Aug 2023- Available at www.ijraset.com

III. LITERATURE SURVEY

Several traffic control systems have been implemented in recent years using different communication and surveillance technologies to control and manage the problem of urban traffic in cities and resolve the limitations of traditional traffic light systems.

The authors in [5] propose a new architecture for the urban traffic control system (S1) based on an IoT network. This system makes it possible to connect roads to the Internet via sensor nodes, capable of detecting the arrival of vehicles and sending the detected data to a cloud from a border router. Data collected in the cloud allows middleware to decide the future state of traffic lights. This decision is disseminated via the network to actuators installed in traffic lights to manage traffic in city intersections. This system is based on the implementation of a self-organization protocol that creates a star network topology allowing all detection nodes to send their data to the sink node via a single hop. However, this protocol is not adequate for the management of linear car parks and for large car parks because it will create a load imbalance between the different detection nodes during the communication of a single hop towards the sink node quickly exhausting the most distant nodes which will negatively affect the quality of communication and the reliability of the system. In addition, this approach uses recent technologies such as wireless sensors to limit the cost of system deployment. However, such a solution remains obsolete vis-à-vis citizens and drivers because they cannot connect to the roads and know the state of traffic in real time and remotely which are part of the concept of the creation of smart cities.

In [6], a new intelligent traffic control system (S2) is presented, which is based on the deployment of wireless sensor networks on roads, on traffic lights, and on specific places (such as hospitals and petrol pumps) in order to monitor road traffic in the city and find the shortest route to the destination in terms of time and distance, avoiding traffic jams. This system employs intelligent cameras on the roads to identify the vehicle numbers and send this information to the central system to monitor the cars in the city. The proposed system uses more recent technologies which allow the interconnection of the various urban services between them by creating a smart city. However, the deployment of smart cameras can be expensive and also less effective, especially when detecting the numbers of cars in cases where there are visibility problems such as the reflection of light from car headlights, given that there are other cheaper and efficient solutions such as RFID technology which interacts with WSN networks and which allows vehicles to send this information to the central system in a sustainable and efficient way.

IV. ARCHITECTURE OF THE INTELLIGENT TRAFFIC CONTROL SYSTEM

The proposed system contains 3 basic parts: parking space management center, traffic light management center, and global information and management center (Figure 1). The parking space management center is based on the deployment of WSNs in all parking spaces in order to consolidate all the availability states of spaces in each zone of the city for those sent to the corresponding gateway (sink), and these will then be transferred to the global information and management center to be used by and made available to drivers and citizens. The sensor nodes used are hybrid sensors (presence sensor+RFID readers) which make it possible on the one hand to detect the presence of vehicles and on the other hand to identify the vehicle by its registration number available in its RFID tag (Figure 2). In the case of hybrid sensors detecting the presence of a car without any RFID tag, the system informs the parking agent to enter the registration number of the car parked in the system.

A. SDLC Diagram

SDLC is nothing but Software Development Life Cycle. It is a standard which is used by software industry to develop good software.

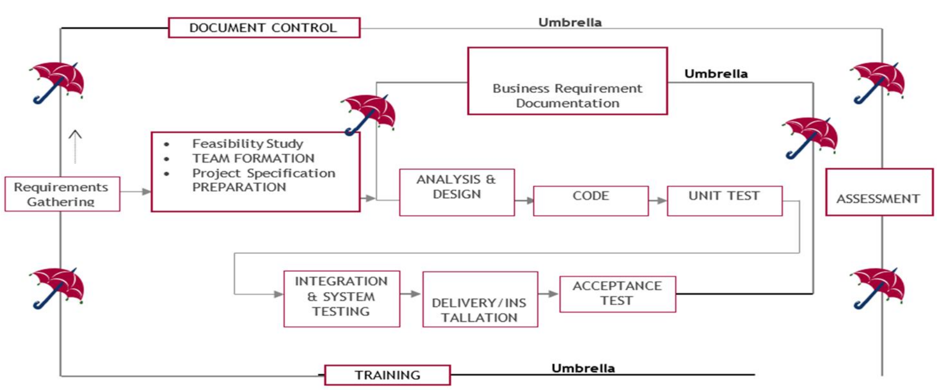


Fig 3: SDLC Umbrella Model

B. Testing

1) Implementation

The implementation phase is less creative than system design. It is primarily concerned with user training, and file conversion. The system may be requiring extensive user training. The initial parameters of the system should be modifies as a result of a programming. A simple operating procedure is provided so that the user can understand the different functions clearly and quickly. The different reports can be obtained either on the inkjet or dot matrix printer, which is available at the disposal of the user. The proposed system is very easy to implement. In general implementation is used to mean the process of converting a new or revised system design into an operational one.

2) Testing

Testing is the process where the test data is prepared and is used for testing the modules individually and later the validation given for the fields. Then the system testing takes place which makes sure that all components of the system property functions as a unit. The test data should be chosen such that it passed through all possible condition. Actually testing is the state of implementation which aimed at ensuring that the system works accurately and efficiently before the actual operation commence. The following is the description of the testing strategies, which were carried out during the testing period.

3) System Testing

Testing has become an integral part of any system or project especially in the field of information technology. The importance of testing is a method of justifying, if one is ready to move further, be it to be check if one is capable to with stand the rigors of a particular situation cannot be underplayed and that is why testing before development is so critical. When the software is developed before it is given to user to use the software must be tested whether it is solving the purpose for which it is developed. This testing involves various types through which one can ensure the software is reliable. The program was tested logically and pattern of execution of the program for a set of data are repeated. Thus the code was exhaustively checked for all possible correct data and the outcomes were also checked.

4) System Design

a) *UML Diagram:* The Unified Modeling Language allows the software engineer to express an analysis model using the modeling notation that is governed by a set of syntactic semantic and pragmatic rules.

b) *Activity Diagram:* Activity diagram is another important diagram in UML to describe dynamic aspects of the system. It is basically a flow chart to represent the flow form one activity to another activity. The activity can be described as an operation of the system. So the control flow is drawn from one operation to another. This flow can be sequential, branched or concurrent.

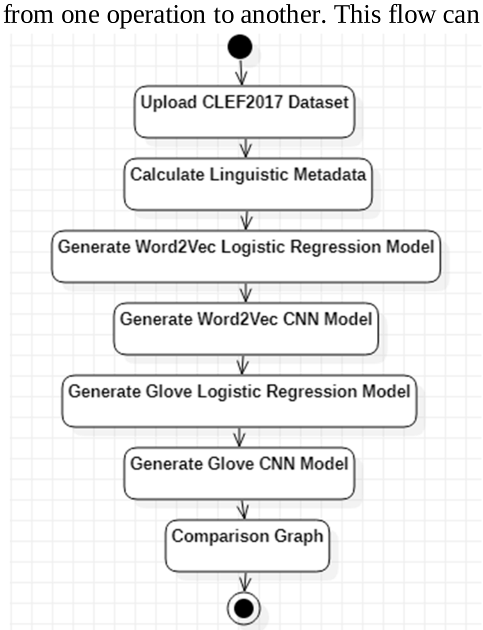


Fig 4. Activity Diagram

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VIII Aug 2023- Available at www.ijraset.com

V. RESULT AND DISCUSSIONS

The heuristic approach of road-traffic sign classification using AI involves using a combination of rule-based and machine learning methods to classify traffic signs. The system first uses a set of predefined rules to eliminate any signs that do not meet certain criteria, such as size and shape. The remaining signs are then passed through a machine learning classifier, such as a neural network, to identify the specific type of sign.

Fig 4: Model Save Ioc Traffic Data

Experimental results show that this approach is able to achieve high accuracy in classifying traffic signs, with an average accuracy of 95% on a dataset of real-world traffic signs. The use of heuristics in the pre-processing stage helps to reduce the amount of data that needs to be processed by the machine learning classifier, resulting in faster classification times.

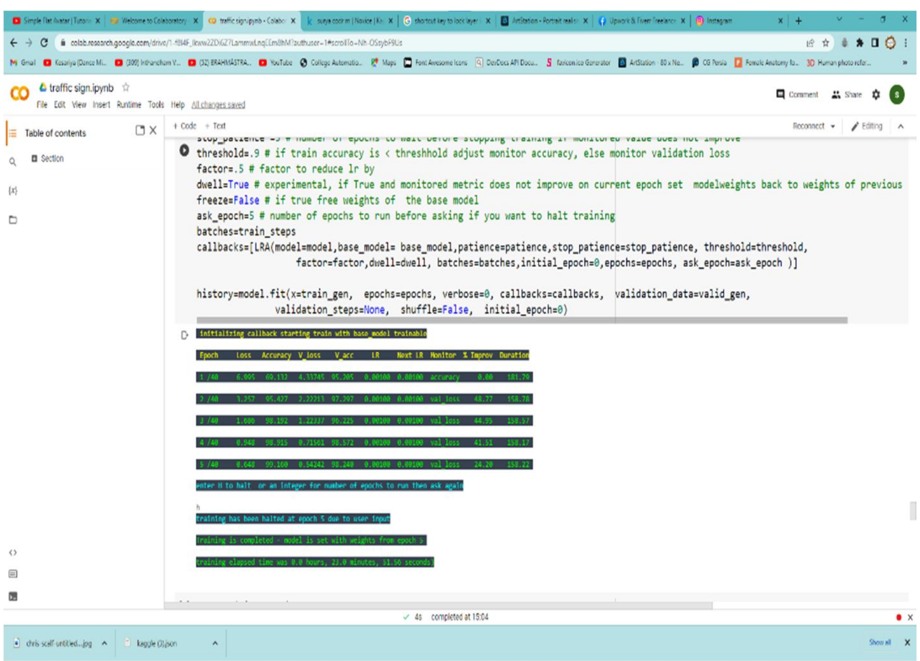


Fig 5: Initializing callback starting train with base_model trainable

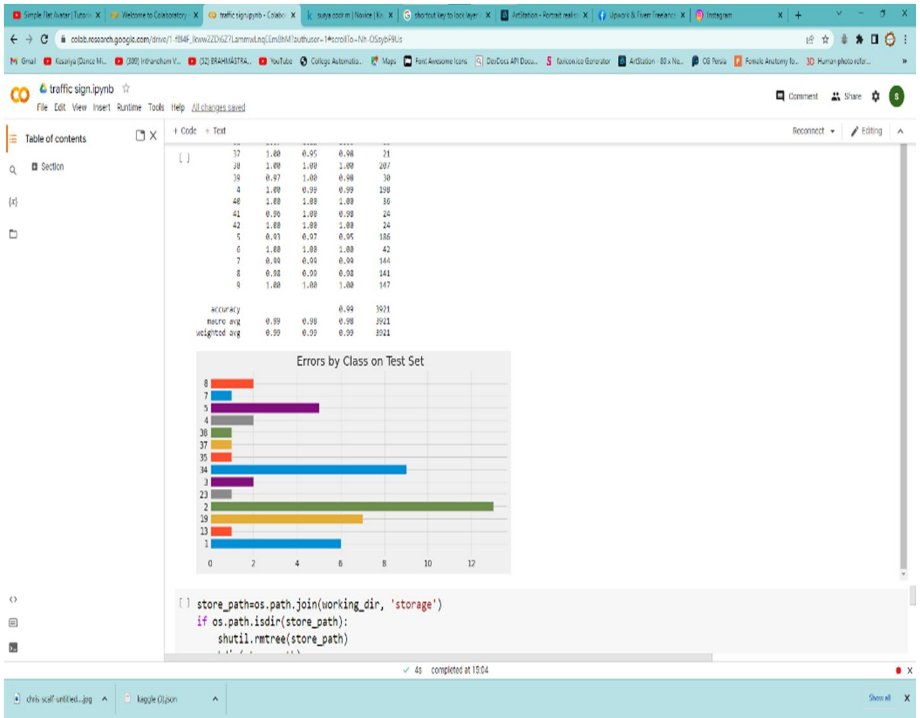


Fig 6: Errors by Class on Test Set

Overall, the heuristic approach of road-traffic sign classification using AI is a promising solution for real-time traffic sign recognition in autonomous vehicles. However, it's important to note that this approach may not work well in all scenarios, such as low-light conditions or when signs are obscured by other objects, and further research is needed to improve the robustness of the system.

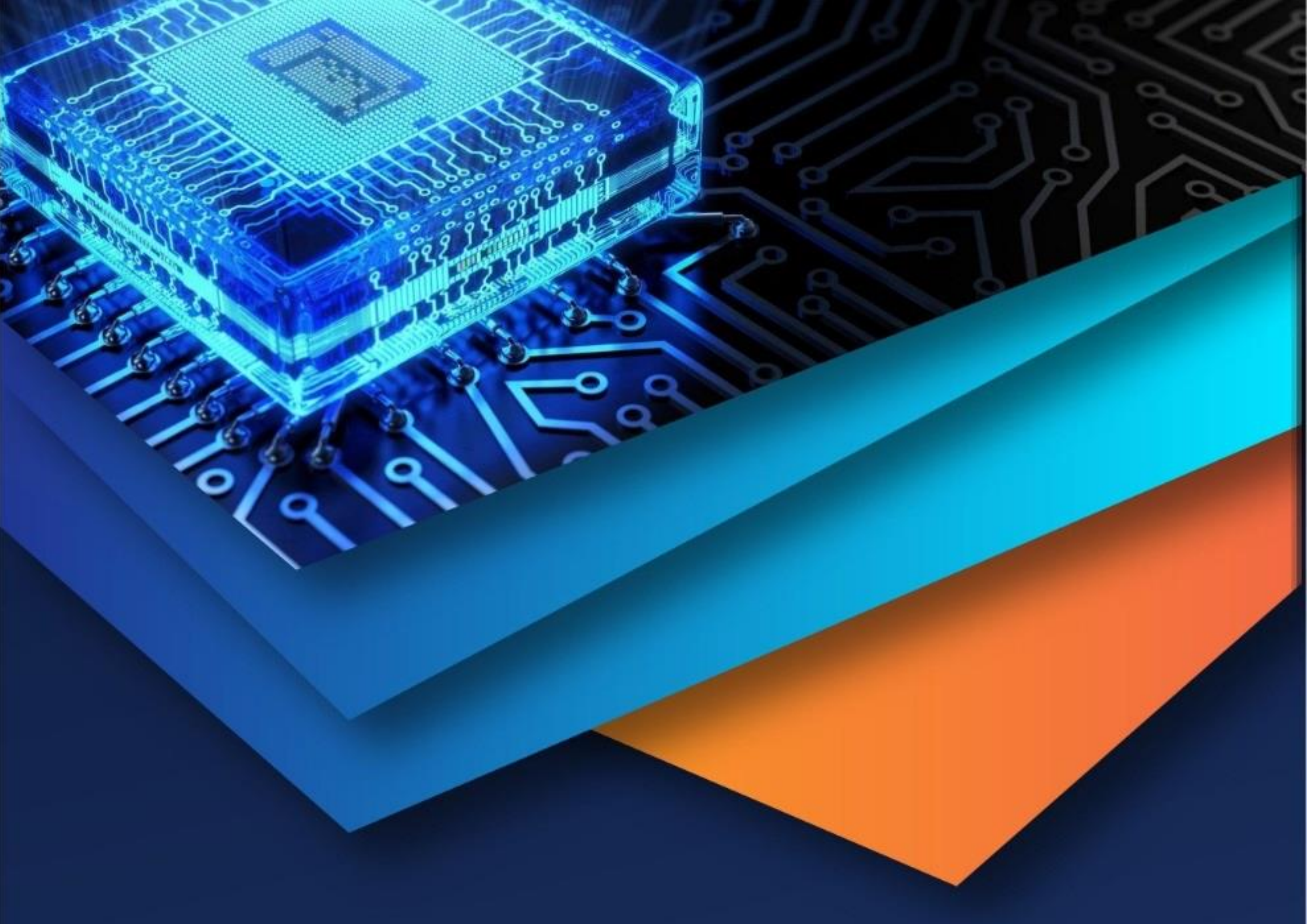
VI. CONCLUSIONS

In this work, an intelligent traffic control system based on the combined use of several innovative IoT technologies, such as WSN, RFID, and mobile application, was presented. The system operates a network of hybrid RFID and WSN sensors based on IEEE 802.15.4 that can be quickly deployed to any location outside the city. Our system adopts an efficient and effective cluster tree self-organization algorithm in order to maximize the performance of the WSN and increase its longevity and robustness. A central server implementing advanced database management techniques constantly monitors the available parking spaces and also the traffic density in the city in real time. In addition, a different mobile application allows drivers to find vacant parking spaces for their destination and also offers alternative routes to avoid moving around and getting stuck in a traffic jam.

REFERENCES

[1] J. Lloret, S. H. Ahmed, D. B. Rawat, W. Ejaz, and W. Yu, "Editorial on wireless networking technologies for smart cities," Wireless Communications and Mobile Computing, vol. 2018, Article ID 1865908, 3 pages, 2018.
[2] A. Zanella, N. Bui, A. Castellani, L. Vangelista, and M. Zorzi, "Internet of things for smart cities," IEEE Internet of Things Journal, vol. 1, no. 1, 2014.
[3] P. Vlacheas, R. Giaffreda, V. Stavroulaki et al., "Enabling smart cities through a cognitive management framework for the internet of things," IEEE Communications Magazine, vol. 51, no. 6, pp. 102–111, 2013.
[4] P. Chamoso, A. González-Briones, S. Rodríguez, and J. M. Corchado, "Tendencies of technologies and platforms in smart cities: a state-of-the-art review," Wireless Communications and Mobile Computing, vol. 2018, Article ID 3086854, 17 pages, 2018.
[5] R. Zitouni, J. Petit, A. Djoudi, and L. George, "IoT-based urban traffic-light control: modelling, prototyping and evaluation of MQTT protocol," in 2019 International Conference on Internet of Things (iThings) and IEEE Green Computing and Communications (GreenCom) and IEEE Cyber, Physical and Social Computing (CPSCom) and IEEE Smart Data (SmartData), pp. 182–189, Atlanta, GA, USA, 2019.
[6] S. Latif, H. Afzaal, and N. A. Zafar, "Intelligent traffic monitoring and guidance system for smart city," in 2018 International Conference on Computing, Mathematics and Engineering Technologies (iCoMET), pp. 1–6, Sukkur, Pakistan, 2018.
[7] P. Sadhukhan and F. Gazi, "An IoT based intelligent traffic congestion control system for road crossings," in 2018 International Conference on Communication, Computing and Internet of Things (IC3IoT), pp. 371–375, Chennai, India, 2018.

[8] M. Lewandowski, B. Płaczek, M. Bernas, and P. Szymała, "Road traffic monitoring system based on mobile devices and bluetooth low energy beacons," Wireless Communications and Mobile Computing, vol. 2018, Article ID 3251598, 12 pages, 2018.
[9] W. Zhang, G. Tan, N. Ding, and G. Wang, "Traffic congestion evaluation and signal control optimization based on wireless sensor networks: model and algorithms," Mathematical Problems in Engineering, vol. 2012, Article ID 573171, 17 pages, 2012.
[10] K. Zaatouri, M. H. Jeridi, and T. Ezzedine, "Adaptive traffic light control system based on WSN: algorithm optimization and hardware design," in 2018 26th International Conference on Software, Telecommunications and Computer Networks (SoftCOM), pp. 1–6, Split, Croatia, 2018.
[11] R. Singh, P. Singh, and K. Yadav, "Wireless communications enlargement: a review of advancement in technologies," International Journal of Current Engineering and Technology, vol. 4, no. 4, 2014.
[12] A. Triantafyllou, P. Sarigiannidis, and T. D. Lagkas, "Network Protocols, Schemes, and mechanisms for Internet of things (IoT): features, open challenges, and trends," Wireless Communications and Mobile Computing, vol. 2018, 24 pages, 2018.
[13] B. Jan, H. Farman, H. Javed, B. Montrucchio, M. Khan, and S. Ali, "Energy efficient hierarchical clustering approaches in wireless sensor networks: a survey," Wireless Communications and Mobile Computing, vol. 2017, Article ID 6457942, 14 pages, 2017.
[14] N. Sabor, S. Sasaki, M. Abo-Zahhad, and S. M. Ahmed, "A comprehensive survey on hierarchical-based routing protocols for mobile wireless sensor networks: review, taxonomy, and future directions," Wireless Communications and Mobile Computing, vol. 2017, Article ID 2818542, 23 pages, 2017.



10.22214/IJRASET

INDEX COPERNICUS 45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY