Traffic Signal Violation Avoidance System

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Abstract – *People frequently disobey traffic signals, cause disruptions, and fail to react appropriately at signal points, which results in traffic jams and accidents. To acknowledge this issue, we installed a road blocker as spike, which prevents the vehicle from relying on the traffic signal and from breaking traffic signal laws. We have speed breakers in the shape of spikes to reduce or regulate the vehicle's speed. By employing a mechanism, we may create a barricade from these speed breakers. We can use the produced barrier to operate a road blocker, which is powered by a timing sensor.*

***Key Words*: Spike, Timing Sensor, Violation**

1.INTRODUCTION

Lester Wire, a Detroit police officer, made the initial discovery of traffic signal in 1912. He recommended a two-colour, red and green light with a buzzer to alert pedestrians of an approaching change in traffic. William Potts then altered this basic design in 1920 to incorporate the commonly used three-color red, amber, and green lights. With minimal deviation, this straightforward, three-color icon has been used with contemporary technology including motion sensors, diode lights, and automated timers for almost a century.

To facilitate the efficient flow of traffic, let vehicles or pedestrians to pass a junction, and lessen the frequency of collisions between cars approaching crossings from opposing directions, traffic lights are primarily designed. Due to the growing number of cars on the road, traffic infractions are becoming increasingly serious both in India and globally. Avoidance systems for traffic violations are necessary to acknowledge the concerning issue.

Spikes are activated by the traffic avoidance system to prevent system hopping. Real-time traffic signal infraction prevention is possible with this system. Additionally, we offer a separate access gate for government class one vehicles and ambulances, among other emergency vehicles. Over the last ten years, India's vehicle population has grown at a rate of about 30% annually.

There is a significant increase in vehicles this year. The world of today is steadily becoming more automated. Everyone demands that everything be networked and automated. This link can be as complex as connecting an American-based phone system to an Indian telephone system, or be as basic as connecting our kitchen oven to our cell phones. IoT promises to be extremely important in meeting this public need.

1.1 OBJECTIVE

The current traffic signal system is set up with delays, and the times during which signals changeover are fixed and independent of the volume of traffic at that moment. To acknowledge the serious issues with traffic congestion, the current traffic system needs to be modernized. Thus, to acknowledge numerous issues and enhance the traffic system, we now suggest a straightforward, reasonably priced, and real-time traffic light system. On the basis of PIC microprocessor, the system measures traffic density by employing dynamic timing slots with varying levels and infrared sensors placed on either side of each route. Our solution will be very helpful in resolving most of today's traffic congestion issues.

1.2 MOTIVATION

Currently in use, traffic signal violation prevention systems mostly rely on manual monitoring and static traffic cameras. These cameras record traffic crossings as pictures or videos. The video is viewed by human operators who look for infractions like speeding and running red lights. This method may take longer and yield lower accuracy. The current traffic signal system is set up with delays, and the times during which signals changeover are fixed and independent of the volume of traffic at that moment. To address the serious issues with traffic congestion, the current traffic system needs to be modernized. Thus, to address numerous issues and enhance the traffic system, we now suggest a straightforward, reasonably priced, and real-time traffic light system. The microprocessor at the heart of the system analyses traffic density. Our solution will be very helpful in resolving the majority of today's traffic congestion issues.

1.3 RELATED WORK

This part presents the recent research on the use of the deep learning for traffic control and load balancing in SDN networks and Mao et al suggested a non-supervised deep learning convolutional neural network-based method for a software-defined wireless network. Compared to conventional routing protocols, this technique can better control network traffic while preserving a higher standard of service Tang et al suggested using two deep-learning CNNs based on intelligent partial overlapping channel assignment to route traffic improving network performance.

To prevent congestion in an IoT network and predict traffic load in future period Mao et al proposed intelligent routing based on a deep learning technique for a CNN in a communication system. Another researcher Yu et al says that a deep reinforcement learning for an SDN that provides effective routing services and good convergence for optimizing the routing of the sensing region. Kumar and Vidyarthi introduced a particle swarm optimization-based green routing technique to maximize the number of nodes and their cluster. The obtained results specify a significant increase in the lifespan of the network.

The software-defined wireless network is gaining traction in the IoT domain. In a brand-new architecture known as SD Sense is proposed. It consists of an SDN-based WSN architecture that significantly improves network performance by dynamically reconfiguring software-enabled sensors to match the network's state. Misra et al proposed a situation-aware protocol switching technique for software-defined wireless sensor networks that allows real-time application. They gave an example of how their protocol might increase network performance.

Another researcher developed and implemented an IoT-integrated system architecture that includes a WSN. A traffic management technique that includes bandwidth allocation, virtual machine based on priority, and a dynamic flow pathing mechanism was proposed by Son and Buyya [24].and Al-Shammari et al developed a traffic flow management policy to organize traffic network resources. Some of the researchers have been working to improve AI as its importance has grown, particularly in the area of algorithm training, where SNNs are quite helpful. Many methods have been proposed and used for aim of training. This study, in contrast to the literature reviewed, builds two controllers within the same IoT control plane using an intelligent stack. Additionally, we offer a revised training to enhance the controllability of an ISDN-IoT spike network.

The algorithm modification is inspired by the spike back propagation (SBP) Our method incorporates an extra training mechanism to prevent accidents that may lead to disturbance in the traffic level forecast.

2. PROPOSED SYSTEM

Cutting edge technology is used in the suggested traffic signal violation avoidance system. The gadget is positioned close to the zebra cross. Furthermore, these gadgets provide real-time autonomous traffic signal detection. Comparing this system to the current approaches, it is more precise and efficient. The two primary parts of the system are a spike and sensors. A signal is picked up by the sensor. The system chooses whether to activate spikes by monitoring the signal light's activity. This method allows us to prevent signal violations. The current traffic signal system is set up with delays, and the times during which signals changeover are fixed and independent of the volume of traffic at that moment. To address the serious issues with traffic congestion, the current traffic system needs to be modernized. Thus, to address numerous issues and enhance the traffic system, we now suggest a straightforward, reasonably priced, and real-time traffic light system.

3. SYSTEM ARCHITECTURE

Following investigations and studies, it was determined that a system is need that would require physical control yet still allow the process to be automated. The automated system offers extremely high efficiency in completing the task at hand, while physical control helps to prevent undesired disruptions in the traffic flow. Artificial intelligence, communications, and network science have advanced recently, which has increased the use of these technologies in many facets of society. Our focus is on the implementation of the proposed paradigm in the medical sphere, specifically in Iraqi hospitals. The spike ISDN-IoT network's sensing, control, and application make up the model.

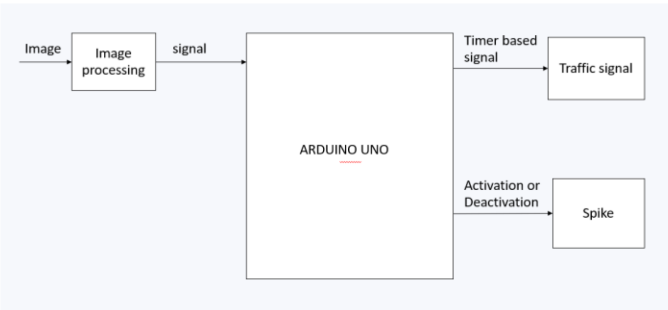

Fig-1 Architecture of traffic avoidance system

Data Flow

Ambulances are intended to be able to navigate the busy and clogged traffic signals with the help of the proposed Smart Traffic Control System. It also facilitates the ambulances' ability to avoid a red light that could obstruct their path. This is crucial in a country like India where there aren't any buffer spaces or designated lanes at the moment that allow ambulances to pass through the traffic.

Using an algorithm to process digital photos on a computer is known as digital image processing. Compared to analog image processing, digital image processing, a subsection or field of digital signal processing, offers numerous advantages. It permits the application of a far greater variety of algorithms to the input data and can prevent issues like noise and distortion accumulation during processing. Digital image processing can be described as multidimensional systems since images are defined over two dimensions. Three key elements have influenced the formation and development of digital image processing: first, the advancement of computers; second, the advancement of mathematics; and third, the growing demand for a wide range of applications in the fields of environment, agricultural, and medical science.

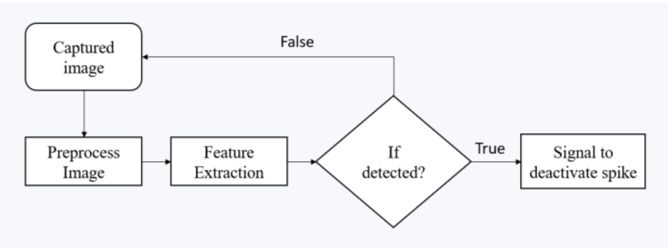

Fig-2 Data flow of image processing

Methodology

1. Model Training

- Dataset Collection: Gathered a dataset containing images of ambulances and non-ambulance vehicles.

- Data Preprocessing: Preprocessed the images to ensure uniform size and format, including resizing and normalization.

- Model Selection: Selected a Convolutional Neural Network (CNN) architecture for object detection, suitable for the task.

- Model Training: Trained the CNN model using the preprocessed dataset to classify images as either ambulance or non-ambulance.

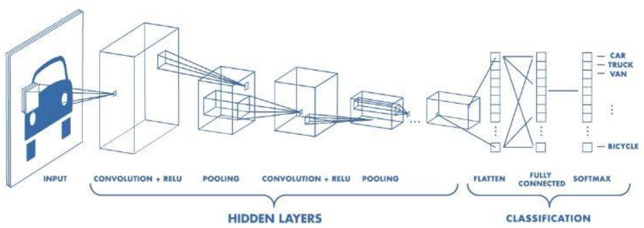

Fig-3 CNN model training and classification

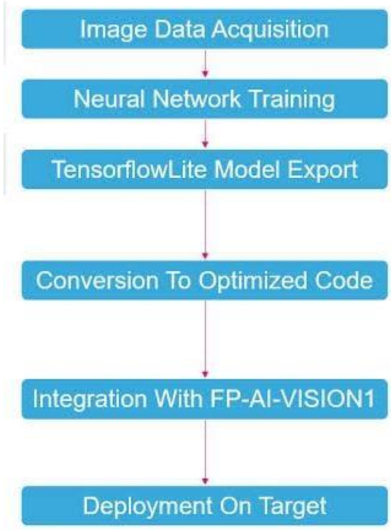

Fig-4 Image Flow

2. Real-Time Object Detection

- Model Loading: Loaded the trained CNN model using the Keras library.

- Video Feed Acquisition: Utilized the OpenCV library to capture frames from a camera in real-time.

- Frame Preprocessing: Preprocessed each frame to match the input requirements of the CNN model, including resizing and normalization.

- Object Detection: Used the loaded CNN model to make predictions on the preprocessed frames to detect ambulances.

- Bounding Box Visualization: Drew bounding boxes around detected ambulances in the frames using OpenCV.

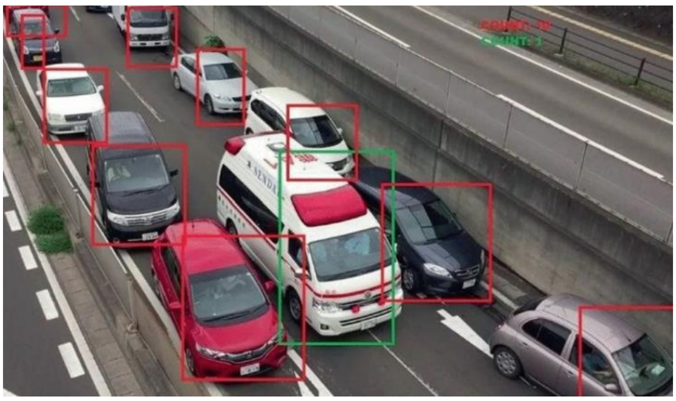

Fig-5 Camera can detect the ambulance in high dense of traffic

3. Integration with Arduino

- Communication Setup: Established a serial communication link between the computer running the object detection code and an Arduino board.

- Signal Transmission: Sent signals from the computer to the Arduino based on the detection results to trigger further actions, such as controlling servos or lights.

- Arduino Processing: Programmed the Arduino to receive signals and perform the desired actions, such as opening barricades or signaling.

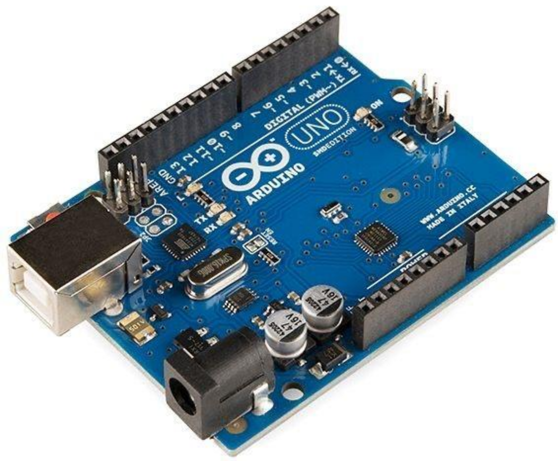

Fig-6 Arduino UNO

The Arduino Uno is an open-source microcontroller board that was created by Arduino.cc and first made available in 2010. It is based on the Microchip ATmega328P microprocessor. Sets of digital and analog input/output pins on the microcontroller board allow it to be interfaced with different expansion boards and other devices. With a type B USB cable and the Arduino IDE, the board's 14 digital and 6 analog I/O pins can be programmed. It can be powered by a rectangular 9-volt battery or a barrel connector that takes voltages ranging from 7 to 20 volts. It shares the same headers as the Leonardo board and the same microprocessor as the Arduino Nano board.

4. System Testing and Validation

- Testing Environment Setup: Set up a controlled environment for testing the real-time object detection and Arduino integration.

- Performance Evaluation: Evaluated the performance of the system in terms of detection accuracy, real-time processing speed, and Arduino response time.

- Validation: Validated the system against a variety of scenarios and conditions to ensure its reliability and effectiveness.

CONCLUSION

Analyzed the results obtained from the system testing and validation to assess the performance of the developed system. Concluded that the system successfully detects ambulances in real-time and integrates with Arduino for further processing, meeting the project objectives.

Using as much of the IoT's resources as feasible while maintaining a minimal design is how this system achieves real-time traffic assistance for ambulances. By helping to provide patients with excellent ambulance care, the suggested design helps to save their lives. By applying it to many parts of potential difficulties, it can grow to become a vital component of municipal administration. The system is simply dependable and its development and installation are economical.

REFERENCES

[1] A. Ghosh, D. Chakraborty, and A. Law, “Artificial intelligence in internet of things,” CAAI Transactions on Intelligence Technology, vol. 3, no. 4, pp. 208–218, 2018.

[2] D. Kaur, G. S. Aujla, N. Kumar, A. Y. Zomaya, C. Perera, and R. Ranjan, “Tensor-based big data management scheme for dimensionality reduce problem in smart grid systems: Sdn perspective,” IEEE Transactions on Knowledge and Data Engineering, vol. 30, no. 10, pp. 1985–1998, 2018.

[3] Z. Han, T. Lei, Z. Lu, X. Wen, W. Zheng, and L. Guo, “Artificial intelligence-based handoff management for dense wlans: A deep reinforcement learning approach,” IEEE Access, 2019.

[4] Q. Li, N. Huang, D. Wang, X. Li, Y. Jiang, and Z. Song, “Hqtimer: A hybrid {Q} − learning-based timeout mechanism in software-defined networks,” IEEE Transactions on Network and Service Management, vol. 16, no. 1, pp. 153–166, 2019.

[5] A. Rego, A. Canovas, J. M. Jime´nez, and J. Lloret, “An intelligent system for video surveillance in iot environments,” IEEE Access, vol. 6, pp. 31 580–31 598, 2018.

[6] X. Huang, T. Yuan, G. Qiao, and Y. Ren, “Deep reinforcement learning for multimedia traffic control in software defined networking,” IEEE Network, vol. 32, no. 6, pp. 35–41, 2018.

[7] F. Tang, Z. M. Fadlullah, B. Mao, and N. Kato, “An intelligent traffic load prediction-based adaptive channel assignment algorithm in sdn-iot: A deep learning approach,” IEEE Internet of Things Journal, vol. 5, no. 6, pp. 5141–5154, 2018.

[8] G. Li, X. Wang, and Z. Zhang, “Sdn-based load balancing scheme for multi-controller deployment,” IEEE Access, vol. 7, pp. 39 612–39 622, 2019.

[9] A. Tavanaei, M. Ghodrati, S. R. Kheradpisheh, T. Masquelier, and A. Maida, “Deep learning in spiking neural networks,” Neural Networks, 2018.

[10] N. Kumar and D. P. Vidyarthi, “A green routing algorithm for iot-enabled software defined wireless sensor network,” IEEE Sensors Journal, vol. 18, no. 22, pp. 9449–9460, 2018.