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Intelligent Based Real Time Traffic Monitoring in Smart Cities

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ABSTRACT

PC-based Intelligent Traffic Monitoring System is unable to deal with the on-going issues surrounding congestion. The current traffic light models are not suited to tackle problems such as traffic jams, ease of access for emergency vehicles and prevention of accidents. In order to counteract these issues, we propose 'PC-based Intelligent Traffic Monitoring System with Real-time Analysis for Smart Cities'. The system consists of a network of cameras installed at strategic locations across the city, which capture images of vehicles and pedestrians. These images are then processed by intelligent algorithms, which analyse the data and provide real-time traffic information. The system is also equipped with a real-time monitoring interface, which displays the traffic data in an easy-to-understand format. The system is designed to help cities optimize their traffic flow and reduce congestion. By analysing real-time traffic data, city officials can make informed decisions about traffic management and can take immediate action to alleviate congestion. This project will focus on two aspects of implementation. First and foremost, to make traffic light controlling more efficient, image processing alongside with embedded system, will be used. This system will intelligently decide when to alternate signals based on the emergency vehicle on each lane which will increase road capacity and traffic flow. Secondly the system favours school students by giving green signal to give them free passage. It is a matter of concern, as emergency vehicles are being categorized as priority vehicles, so their waiting time should be minimum.

Keywords: Smart city; Traffic monitoring; Internet of Things (IoT).

1. Introduction

In every intelligent traffic management system, traffic light control is critical. In traffic light monitoring, the sequence of green lights and the length of green lights are the two most significant variables to consider. Most traffic lights in many countries include fixed light sequence and light time duration. Priority crews methods, but at the other hand, are suitable for secure or normal traffic, not for dynamic traffic. In the present state of operation, the sequence of green light is established with-out taking into account the possibility of the presence for emergency priority vehicle [1]. As a response, emergency vehicles such as, police cars, fire trucks, ambulances and other types of emergency vehicles wait in traffic points at intersection, avoiding their arrivals at particular result and destination in the loss of life and property. Ireland, an average of 700 fatalities was noted every year due to come late ambulance vehicle responses [3].

The PC-based Intelligent Traffic Monitoring System with Real-time Analysis for Smart Cities is a system designed to help smart cities monitor and analyze traffic in real-time. The system is built on a computer platform and uses intelligent algorithms and data analysis techniques to provide real-time traffic data. The system is also designed to be highly scalable and can be customized to meet the needs of different cities. It can be integrated with other smart city systems, such as public transportation systems and emergency services, to provide a comprehensive solution for urban traffic management. The world population presently stands at 7.8 billion, and the demographers expect the 8 billion milestones in 2023, with the global population projected to reach 10 billion by 2056. The rapid increase of the population's size, mainly in the major cities the continually rising number of road users, are not attended with the enhanced transportation system, thus causing severe traffic congestion. Critical traffic congestion

not only leads to substantial economic lost but also has negative impacts on the quality of community life. Aged traffic signaling systems, insufficient police manpower, limited road spaces and bad driving habits create pro-longed traffic congestions. The system proposes a traffic system that facilitates the emergency vehicle passing through the intersection fast. Thus the signal controller can react effectively in the case of emergency vehicle need to pass the lane [3].

An image processor does the functions of image acquisition, storage, pre-processing, segmentation, representation, recognition and interpretation and finally displays or records the resulting image. Figure 1 shows the fundamental sequence involved in image processing.

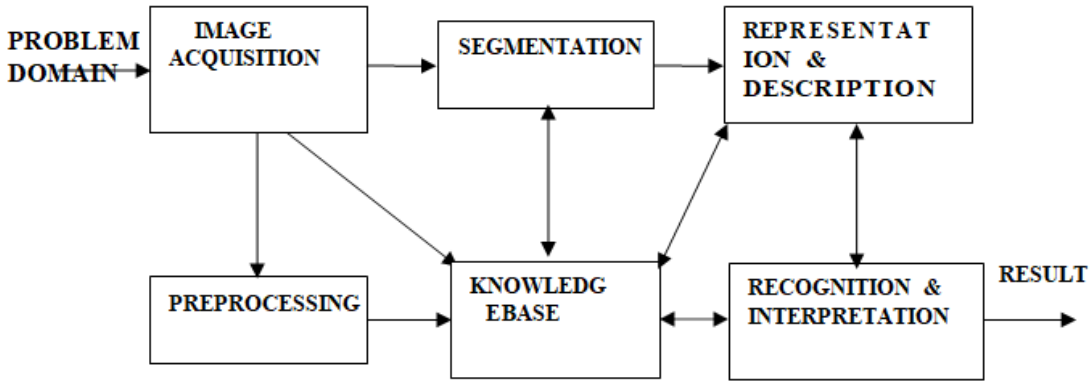

Figure 1. Fundamental sequence involved in an imageprocessing

As shown in figure 1, the first step in the process is imageacquisition by an imaging sensor in conjunction with a digitizer to digitize the image. The next step is the pre-processing step where the image is improved being fed as an input to the other processes. Pre-processing typically deals with enhancing, removing noise, isolating regions, etc. Segmentation partitions an image into its constituent parts or objects. The output of segmentation is usually raw pixel data, which consists of either the boundary of the region or the pixels in the region themselves. Representation is the process of transforming the raw pixel data into a form useful for subsequent processing by the computer. Description deals with extracting features that are basic in differentiating one class of objects from another. Recognition assigns a label to an object based on the information provided by its descriptors. Interpretation involves assigning meaning to an ensemble of recognized objects. The knowledge about a problem domain is incorporated into the knowledge base. The knowledge base guides the operation of each processing module and also controls the interaction between the modules. Not all modules need be necessarily present for a specific function. The composition of the image processing system depends on its application. The frame rate of the image processor is normally around 25 frames per second [4].

2. Literature Review

Conventional methods of traffic light systems are unable to deal with the ongoing issues surrounding congestion. The current traffic light models are not suited to tackle problems such as traffic jams, ease of access for emergency vehicles and prevention of accidents. In order to counteract these issues, we propose the 'Smart traffic light control system' [5]. The adopted Traffic Light Controllers (TLC) in Gaza, are based on microcontroller and

microprocessor. These TLCs have limitations because they use the pre-defined hardware, which is functioning according to the program that does not have the flexibility of modification on real time basis. Due to the fixed time intervals of green, orange and red signals the waiting time is more and car uses more fuel. Total traffic on each road detected by cameras on each lane which will increase road capacity and traffic flow. Control the traffic signals by an android application throughout the Bluetooth and wireless connection. This will be controlled by the traffic warden or police officer [6],[7].

The problem of urban traffic stoppage is invariably spreading. The increased traffic is due to the increasing number of vehicles and the limited expansion of the roads. We propose a system to reduce traffic congestion by using sensors to detect Ambulance. The system will detect through sensors instead of using image processing. We also plan to provide a suitable solution for emergency vehicles stuck in traffic to clear their way using the Ambulance indicator thus ensuring timely assistance to those in need. The main motto behind our project is to provide a smart way to control traffic lights and also to provide a smooth flow of ambulances to the hospital in time. We will be implementing a new mode called «ambulance mode» that will control the traffic lights on the road of the ambulance. The program is fully automatic so it controls the traffic lights, helping to get to the hospital in time. This is not just a priority for ambulances. It is ideal for emergency vehicles such as fire trucks [8]-[10].

Traffic congestion has become a significant problem due to increasing vehicle usage. The main challenge is reducing traffic congestion and ensuring a smooth and safe traffic flow. Lately, image processing technology has been studied to improve traffic issues and make traffic light controllers more intelligent. It removes limitations in earlier standard traffic control systems. This paper pro-poses a traffic control system using Raspberry Pi and image processing techniques. The camera with a top viewing angle at the intersection monitors the four intersections in real-time [11],[12]. The captured images are processed using a series of image processing techniques. This method is performed on the recorded image to realize the identification and counting of cars. The Raspberry Pi calculates flexible green light duration based on the measured traffic density on the road. Most cars at intersections are given priority instead of cars with a small number. For the same amount, the system will prioritize vehicles on horizontal lane A first, along horizontal lane B, then along with vertical lane A, and finally along vertical lane B. The model was tested, and the model's outcome was as expected [13].

The popularity of private cars has increased the number of vehicles on the road day by day, which has led to a dramatic increase in traffic. Hence, traffic congestion has become a common phenomenon nowadays. This can cause a lot of problems, especially in emergency situations where the traffic at intersections is always busy. Whether it is an ambulance, a fire engine or a police car, traffic jams and delays are often encountered during emergency operations or rescue. Therefore, there is a need for a traffic light system that prioritizes emergency vehicles and dynamically adapts changing traffic conditions. In this project, a prototype of a traffic light system that consider emergency vehicles as priority was created based on Internet of Things (IoT) technology [14]. The traffic light prototype was implemented using Arduino Uno with radio frequency (RF) transmission with 433 MHz RF modules. The traffic light system works normally until it receives a signal from an emergency vehicle, the lights sequence will change to help emergency vehicles pass the busy traffic junction fast. To evaluate the significance of the system, a survey was made to evaluate the usability and usefulness of the prototype [15].

To address some of the challenges, a smart density-based traffic control system is proposed with barricades and emergency clearance to address the abuses and restructure the system to achieve a free traffic flow in the state. This system is designed to do away with a manual system of traffic control, grant quick but logical access to an emergency vehicle, and replace the counter system of signal light using Pre-Empty Priority scheduling algorithm to assign higher priority to emergency vehicles [16]. C programming language is utilised with the aid of IR sensor, Arduino AT Mega 2560, RF transceiver, LED, barricade and metal-gear-micro servo motor. The suggested system is assessed based on response time after trials for the speed of the servo motor. Setting the servo motor speed from 00 to 900 and back to 00 shows that the get ready to stop is recorded at 2000 microseconds. After five trials, 8,7 and 9,8 seconds were obtained for Road 1 and Road 2 as the high and low values, respectively [17].

3. Proposed Method

Already available system for traffic control consists of three modules, the traffic light control module, the emergency Radio-frequency identification (RFID) module and the internet module. The traffic light control module detects vehicular density using ultrasonic sensors and assigns a dynamic set of cycle length based on the individual lane density condition. The emergency RFIDs are installed on different types of EVs based on the pre-set priority weights. The internet module allows the dynamic traffic light system to be controlled by authorized personnel in a real-time application. The major drawbacks are huge cost, less efficient, and implementation is difficult one.

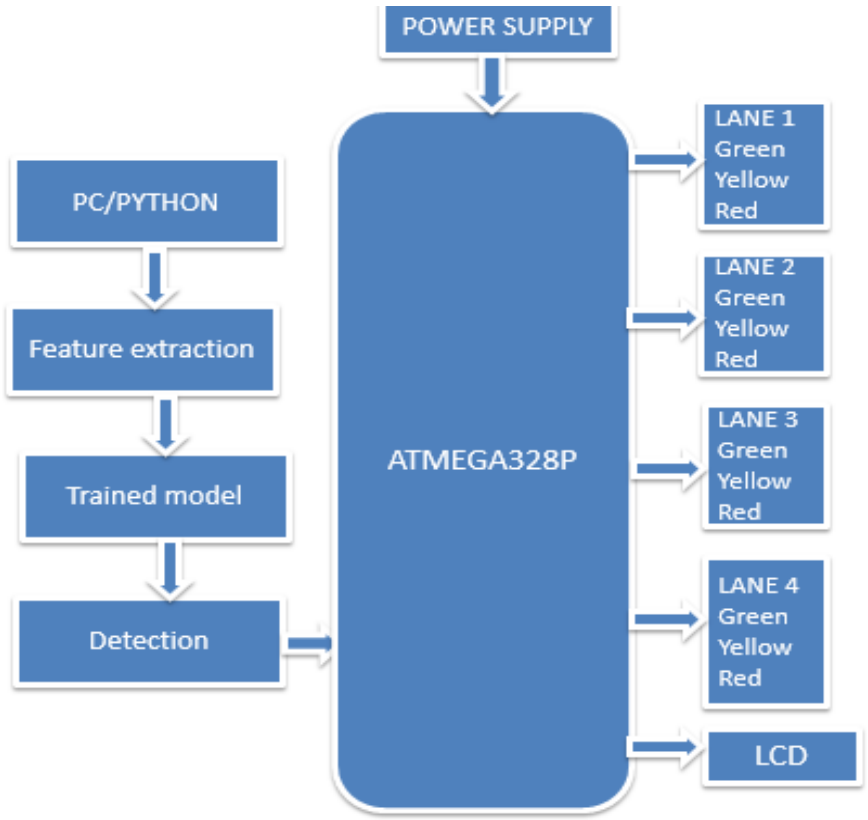

Figure 2. Proposed system

To avoid the above mentioned drawbacks from the existing system, we proposed a new system which utilizes intelligent algorithms and data analysis techniques to provide real-time traffic data, allowing city officials to make

informed decisions about traffic management. The system is designed to be highly scalable and customizable, making it suitable for cities of all sizes. It can be integrated with other smart city systems, such as public transportation and emergency services, to provide a comprehensive solution for urban traffic management. The proposed system can bring numerous benefits to smart cities, including improved traffic flow and reduced congestion, which can enhance the overall transportation experience for city residents and visitors. Additionally, the system can help to reduce pollution and promote sustainable transportation practices, contributing to a more environmentally friendly and sustainable city. This paper proposes a system that intelligently adjusts traffic light system response based on the emergency vehicle. The emergency vehicle such as Fire engine and Ambulance images are processed in PYTHON and the control is given the controller. The controller gives green signal to facilitate easy passage for the emergency vehicles in that particular lane. If ambulance moves to the way the controller controls the traffic light to give green signal for that particular lane. So the controller controls the traffic light to give green signal for that particular lane. The system information's are displayed in the LCD display. Figure 2 shows the block diagram of the proposed system.

4. Conclusion

In conclusion, the PC-based Intelligent Traffic Monitoring System with Real-time Analysis for Smart Cities is an essential tool for managing traffic in modern urban areas. With the help of intelligent algorithms and real-time data analysis, this system provides accurate and timely traffic information to city officials, allowing them to make informed decisions about traffic management. By optimizing traffic flow and reducing congestion, this system can improve the overall transportation experience for city residents and visitors. It can also help to reduce pollution and promote sustainable transportation practices. The system's scalability and flexibility make it a valuable asset for cities of all sizes and can be customized to meet the unique needs of each city. By integrating with other smart city systems, such as public transportation and emergency services, it provides a comprehensive solution for urban traffic management. Our prototype successfully operated using image processing and embedded system. It was clear that traffic congestion can be reduced and there will be less delays in real waiting time. Furthermore the system is more consistent in detecting vehicle presence because it used actual traffic images. It visualized the reality so it functioned much better than those systems that rely on the detection of the vehicles' metal content. The proposed system was able manage traffic at a particular lane, dedicating switching of green light for the emergency vehicle and school students in the particular lane.

Declarations

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Competing Interests Statement

The authors declare no competing financial, professional, or personal interests.

Consent for publication

The authors declare that they consented to the publication of this research work.

References

[1] Joseph Chamie (2020). World Population: 2020 Overview. Yale Global Online, Yale University.

[2] Muhd Uzir Mahidin and Mohd Yusrizal Ab Razak (2020). Current Population Estimates, Malaysia 2020. Department of Statistics Malaysia.

[3] D. Nathangashree, L. Ramachandran, S. Senthilkumar & R. Lakshmirekha (2016). PLC based smart monitoring system for photovoltaic panel using GSM technology. International Journal of Advanced Research in Electronics and Communication Engineering, 5(2): 251-255.

[4] Wei-Hsun Lee and Chi-Yi Chiu (2020). Design and Implementation of a Smart Traffic Signal Control System for Smart City Applications. Sensors.

[5] Wan Noratikah Wahidah Binti Wan Ghazali, Che Nurhamizah Atikah Binti Zulkifli, Zakiah Ponrahon (2019). The Effect of Traffic Congestion on Quality of Community Life. In 4th International Conference on Rebuilding Place, December 2019.

[6] Jericca (2020). Malaysians waste RM 1020 billion annually on traffic congestion.

[7] Gupta, Manish, Divesh Kumar, and Manish Kumar (2021). IoT-based smart traffic light system for smart cities. In Proceedings of Second International Conference on Smart Energy and Communication. Springer, Singapore.

[8] A.Asuvaran & S.Senthilkumar (2014). Low delay error correction codes to correct stuck-at defects and soft errors. In 2014 International Conference on Advances in Engineering and Technology, doi: 10.1109/icaet.2014. 7105257.

[9] Siddiqui, Shahan Yamin, et al. (2021). A IoT Enabled Traffic Congestion Control System Using Deep Neural Network. EAI Endorsed Transactions on Scalable Information Systems, 8(33): e7.

[10] S.Suganya, R.Sinduja, T.Sowmiya & S.Senthilkumar (2014). Street Light Glow on Detecting Vehicle Movement Using Sensor. International J. for Advance Research in Engineering and Technology, ICIRET-2014.

[11] Shylashree, H.B., et al. (2021). Density-Based Smart Traffic Light Control System for Emergency Vehicles. Advances in Clean Energy Technologies, Springer, Singapore, Pages 551-561.

[12] Ahmad, Sarfraz, and K.C. Maurya (2021). Emergency Vehicle Priority Based System. Emergency, 5(6).

[13] Kulkarni, Sahana, et al. (2021). Review on Traffic Congestion Detection using Image Processing. Journal of Science and Technology, 6(2): 109-113.

[14] Kee, Low Kai, and Zainab Senan Attar Bashi (2021). Smart Traffic Light Monitoring System for Emergency using Arduino. Multidisciplinary Applied Research and Innovation, 2(3): 015-020.

[15] Senthilkumar S, Lakshmi Rekha, Ramachandran L & Dhivya S. (2016). Design and Implementation of secured wireless communication using Raspberry Pi. International Research Journal of Engineering and Technology, 3(2): 1015-1018.

[16] Guneş, Peri, and Osama Bittar, Design Intelligent Traffic Light System Using Image Processing.

[17] Alsaawy, Yazed, et al. (2022). A Comprehensive and Effective Framework for Traffic Congestion Problem Based on the Integration of IoT and Data Analytics. Applied Sciences, 12(4): 2043.