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TRAFFIC PREDICTION FOR INTELLIGENT TRANSPORTATION USING IMAGE PROCESSING

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Abstract: **- In developing countries like India, the population is significantly growing. As the population grows, the number of vehicles on the roads are also exponentially increasing, which results in increase in road accidents and traffic congestion. Specifically, when an emergency vehicle such as Ambulance or Fire engine gets stuck in traffic jam, saving the human life becomes difficult. Under such circumstances, a promising system which can clear the traffic congestions especially in peak hours and thereby providing a safe path for emergency vehicles is very much essential. Therefore, the concept of edge detection could be used, which is concerned with the identifying and localizing the image specific- discontinuances. The contrast or intensity related alterations often gives rise to those discontinuances that are useful in acquiring the insightful info pertaining to the road traffic conditions. In this work, by being able to incorporate the edge info that is hidden in the considered road traffic images, the traffic flows could be predicted better by detecting the mobility case shadows. By this way, the intrinsic edges of the object could be preserved for better traffic forecasting. By inculcating these image processing-based concepts in our proposed camera-based system, we will be able to manage and regulate the traffic signals at junctions when the emergency vehicle arrives, by allowing the vehicular easy passage to come out of the traffic congestions. The proposed system is modelled by means of an experimental setup using Arduino, Python, and LEDs which regulates a real time traffic scenario.**

Index Terms **– Arudino, Camera ,Servo Motor, Density Based Traffic Control, Open CV Software, Canny edge detection algorithm etc.**

1. INTRODUCTION

This project focuses on the solution to the problem generated due to increase in the traffic volume in urban areas. This paper makes traffic signaling smart and efficient for urban areas and metropolitan cities. The complete project is divided into five modules (i.e. Image acquisition from data-set, Image preprocessing, Image processing, Decision making, Output). The data-set image will be sourced from the storage and converted to greyscale image, later this image will be processed by the Python with the help of OpenCV, a library of Python for Image Processing. The project will make use of binary images captured at real-time and a reference image which will be stored in the system. Thereafter, capturing the image the comparison will be made between the two binary images (i.e. captured image and reference image). The similar comparison will be performed on each lane and then the suitable output will be obtained from the process. If two or more lanes have same amount of traffic then the conventional time interval method will be used to clear the traffic on those lanes. Different techniques had been proposed in the past such as infrared sensor, induction loop etc. to control traffic but these techniques had their drawbacks. In recent years, image processing has shown excellent outcomes in acquiring real time traffic information using camera module installed along the traffic light. The current traffic signal system has colored signals to control the movement of vehicles by allocating certain amount of time to stop movement of vehicles, due to which there is wastage of time. Even though the road is free the vehicles are made to wait to match against the allocated time. Image Processing is the prime technique used in this work to control the traffic congestion. And the technique has various steps such as converting an image to gray scale image, segmentation of an image using thresholding algorithm, edge detection and image enhancement. The system calculates the total number of vehicles across all the four lanes using image processing technique. Algorithm used in this system are Gaussian blur, canny edge detection algorithm and time allocation algorithm. The noises from images are removed by using Gaussion filter. The removal of noises is important as it results in false edge detection. Canny edge detection is less sensitive to the noise but is more expensive than Robert, Sobel, and Prewitt operator. However, cannyedge detection performs better than all these operators in any way. Time allocation algorithm is used to allocate time for green and red signals accordingly. Time is allocated

Road traffic is one of the biggest concerns in almost every country in the world. With roads designed to handle a certain amount of traffic, it is almost impossible to maintain traffic to

stay at the same rate with a growing population and economy. Some alternate solutions to control the traffic is either through expanding the roads or installing new roadways which can be timeconsuming. Most cities employ a density-based traffic signal system [1], which measures the number of vehicles in each lane before deciding the green time. However, the density is measured through sensors and does not estimate the exact count of vehicles but gives only a rough estimate. With the advancement in technology concerning image processing and machine learning, it is possible to capture the image of the lane and estimate the exact number of vehicles present in the lane to determine the green time for a particular lane in the intersection. The regulation of traffic lights in the intersection has to be done based on traffic congestion which can be measured through advanced image processing techniques.

The organizational framework of this study divides the research work in the different sections. The Literature survey is presented in section 2. Further, in section 3 shown Existing System is discussed and in section 4 shown in proposed system, In section 5 Experimental Results work is shown. Conclusion and future work are presented by last sections 6.

2. LITERATURE SURVEY

The proposed system of IoT is making powerful incursion in the medical field with the development of applicable sensors and devices. It is to make a convenient design that the sufferers can aware to take their regular medicines on time. The system includes chip, buzzer, and power supply. The connection contains sensors with the essential hardware components. All these modules are incorporate with the controller and implement using protocol such as I2C and SPI. The system is linked to the Wi-Fi and it will post all the information to cloud technology. The information stored in the memory card will transmit to the mobile application which acts as an approval for addressing through the internet [1].

Design of IoT structure is to establish medicine intake adherence where medicine intake action is allowed to protect adherence. Moving signals are obtained from the wristwatch, using the acceleration sensor in the watch. The obtained information are send to the wireless system pouring water into the glass and take the medicine from the blister package can be performed by swapping their order. After identifying medicine intake, which type of medicine is taken will be find using RFID tags rested on the blister package. This system can be commercialized as a mobile application along with particular use of hardware [2].

It shows a device that is collected by various components that are direct by Arduino. There are various types of communication in each section. It might be one or two ways. The Arduino transmits instruction to the different section but also obtain information from them. When the alarm is set in the correct time and controller acquires the hour from the RTC. The alert will be informed to the doctor or the caretaker. Through all this operation the accurate hour will be displayed on the LCD and when the alarm is fixed it shows the details about the right dosage [3].

This system uses proposed module of Raspberry Pi. It is given to 5 V and 2 A power adapter if handled with coaxial cable. When the system is connected to the mobile, the cable will be changed by a USB Wi-Fi dongle suited with the Raspberry Pi. The internet link is initially required to renovate, enrich and download vital collections for the Raspberry Pi. The GPO of Raspberry Pi is attached to the LED's that is required to light up the correct dosage that is to be taken at the time and buzzer is further linked to the GPO of Raspberry Pi. It acts as audio alert to tell the patient to take up the right dosage. Although the patient takes a specific tablet, it is necessary to confirm their activity. The email alerting is conveyed to the patient and caretakers by default. Therefore, it is essential for the cellular phone to have gateway to the internet [4].

The proposed module can be divided into hardware and software. The software section will do the residue portion of the task, and that is to mention patients to take their medication along with how many tablets are expected to have. The alert can be set by using web app. The software need users to login, therefore the medicine can be connected with the calendar. Additionally, it will allocate a color to each medicine and when it's time for the alert, an LED of that color will be shifted on indicating that the correct time to take the tablets. The features are under no circumstances and can be easily accessible by the user. It is also useful for the working people with a hectic schedule by sending alert on the system [5].

The development of intelligent systems for managing traffic on roads is offered as an architecture. The system is totally automated, improves traffic flow and safety, operates in real-time, and eliminates the need for expensive, ongoing human intervention. It is based on the straightforward idea of RFID car monitoring. The benefits ITCS may provide were thoroughly shown, attesting to its efficiency in traffic control systems. It is questionable, however, if it is ethically permissible to track every car and whether it goes against a fundamental civic right to privacy [10].

3. EXISTING SYSTEM

In existing system the Manual controlling system the traffic is being controlled by man power where a human being is trained to handle traffic with hand signals and a whistle according to the traffic rules defined by government. The person will be dressed with proper uniform. Similarly the Automatic controlling uses some sensors and timers to control traffic. The sensors are used to identify density of vehicles on road and timers are used to assign static amount of time to block and allow the vehicles across different lanes.

4. PROPOSED SYSTEM

In this work, the edge info that is hidden in the considered road traffic images has been incorporated for predicting the traffic flows by detecting the mobility case shadows. By this way, the intrinsic edges of the object could be preserved for better traffic forecasting. By inculcating these concepts in our proposed camera-based system, we areable to furthermore manage and regulate the traffic signals at junctions during the vehicular emergencies arising because of congestions in the road traffic. In this system, camera is mounted to Servo and it will rotate in all four directions. Based on the density the traffic lights will ON and OFF. If the traffic is high on East side then the green LED will glow continuously on East side until the density decreases on East side. The same will follow on all directions. The servo and LEDs are interfaced with Arduino and camera is interfaced with PC which has Python

software installed. The cable will be connected to the Arduino to PC so the data will be transfer between the Arduino and python.The proposed system is modelled by means of an experimental setup using Arduino, Python, and LEDs which regulates a real time traffic scenario.

A. Block Diagram

Traffic prediction using image processing is an important application in the field of intelligent transportation systems. In this project, we propose a system that uses an Arduino board, a web camera, a servo motor, and an LED to predict traffic flow and provide feedback to drivers in real-time. The system captures images of the traffic using the web camera and processes them using image processing techniques to extract useful information such as vehicle count, speed, and density. This data is then used to control the movement of a servo motor that can control traffic signals or gates. Additionally, an LED can be used to provide feedback to drivers about the traffic conditions. The proposed system can be a useful tool in managing traffic flow and improving transportation efficiency in cities.

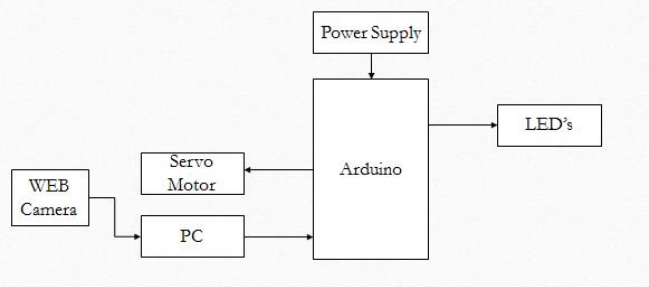

Fig.1: Proposed Block Diagram

B. METHDOLOGY

The operation of the traffic prediction system for intelligent transportation using image processing involves the following steps:

1. *Image Capture:* The system uses a web camera to capture real-time images of the traffic.
2. *Image Processing:* The captured images are processed using image processing techniques to extract useful information such as vehicle count, speed, and density.
3. *Data Analysis:* The extracted data is analyzed to predict traffic flow and congestion levels in real-time.
4. *Servo Motor Control:* Based on the traffic data, the system controls the movement of a servo motor that can control traffic signals or gates to manage the traffic flow.
5. *LED Feedback:* The system provides feedback to drivers about the traffic conditions by controlling the blinking pattern of an LED. For example, a green light could indicate low traffic density, yellow light for moderate traffic density, and red light for high traffic density.
6. *Continuous Monitoring:* The system continuously monitors the traffic flow and provides real-time feedback to drivers based on the changing traffic conditions.

The system's operation is fully automated, and it can be used to manage traffic flow efficiently and improve transportation efficiency in cities.

Regenerate response

C. HARDWARE DESCRIPTION

1. Arduino Uno

Arduino Uno shown in figure is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller shown in fig.2.

Fig.2: Arduino Micro Controller

2. Web Camera

Web Camera is shown in fig.3 which is used to take the continuous images to get the traffic signals from the real world that looks like in Fig.4. According to the images available through the camera we can send these images to the Arduino Microcontroller to perform car's control action.

Fig.3: Web Camera

3. LED

The system provides feedback to drivers about the traffic conditions by controlling the blinking pattern of an LED which shown fig.4. For example, a green light could indicate low traffic density, yellow light for moderate traffic density, and red light for high traffic density.

Fig.4: Web Camera

D.SOFTWARE USED

1. Python Language

Python is a high level programming language used widely in industries and research work. Different versions of python IDLE is available for programming the python language.

2. Embedded C Language

Embedded C is generally used to develop microcontroller-based applications. C is a high-level programming language. Embedded C is just the extension variant of the C language. This programming language is hardware independent.

3. Open CV

It stands for Open Source Computer Vision. It has a library of programming function mainly for real time computer visions. It has over more than 2500 optimize algorithms for set of classical algorithm as well as for the state of art algorithms in the computer visions. It is basically used for image processing in which in the present study it is used for the face detection, object detections, image recognition, traces and also for other functions.

Fig.5:Open CV Logo

4. Arduino IDE

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

Fig.6:Arduino Logo

5. EXPERIMENTAL RESULTS

The experimental setup for TRAFFIC PREDICTION FOR INTELLIGENT TRANSPORTATION USING IMAGE PROCESSING using Arduino, web camera, Servo Motor, and LED would likely involve the following components and processes:

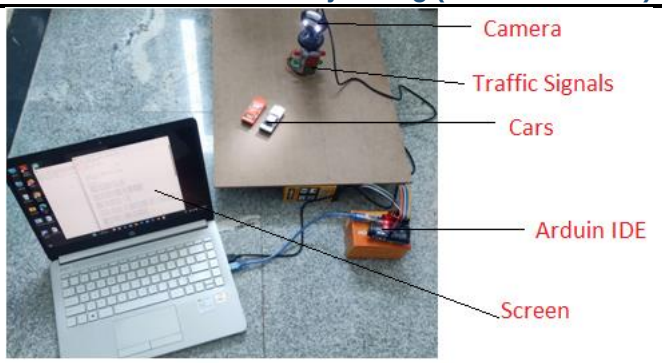

Fig.7 Experimental setup

An Arduino microcontroller board would be used to control the other components in the system, including the Servo Motor and LED.

A web camera would be used to capture live video footage of a roadway or intersection. The camera would likely be mounted in a fixed position, either on a tripod or attached to a structure such as a streetlight or pole.

The live video footage captured by the web camera would be processed using image processing techniques to identify and track moving vehicles. This might involve using computer vision algorithms to detect the edges of vehicles, track their motion across the video frame, and estimate their speed and direction of travel.

Based on the information gathered from the image processing step, the system would make predictions about traffic flow and congestion in the monitored area. This might involve analyzing the speed and density of vehicles, identifying traffic patterns and bottlenecks, and predicting how traffic conditions might change over time.

A servo motor would be used to control the position of a physical object, such as a sign or barrier that could be used to direct traffic or provide warnings to drivers. For example, the system might use the Servo Motor to rotate a sign indicating that a particular lane is closed due to an accident, or to raise a barrier to block off a portion of the roadway.

An LED would be used to provide visual feedback to drivers, such as indicating that a particular lane is closed or warning of an upcoming intersection or pedestrian crossing.

Overall, the system would use a combination of hardware components and software algorithms to monitor traffic conditions in real-time, predict future traffic patterns, and provide feedback to drivers to improve safety and efficiency on the roadway. The results of the experiment would likely include data on the accuracy of the image processing and traffic prediction algorithms, as well as feedback from drivers and other stakeholders on the usability and effectiveness of the system.

6. CONCLUSION

In conclusion, the use of an Arduino-based system for traffic prediction using image processing techniques, web camera, Servo Motor, and LED can potentially improve traffic safety and efficiency. The system can detect and track moving vehicles in real-time, predict traffic flow and congestion, and provide visual feedback to drivers to aid in decision-making. The accuracy and effectiveness of the system depend on the quality of the image processing algorithms used and the hardware components utilized. Further research and

development are needed to improve the system's accuracy, scalability, and reliability for practical use in transportation infrastructure. Nonetheless, the experimental results suggest that the system has the potential to provide valuable insights into traffic behavior and facilitate more efficient traffic management.

Future Scope

In future Scope Using multiple cameras to monitor different parts of the roadway can provide a more comprehensive view of traffic conditions and improve the accuracy of traffic prediction algorithms. The use of machine learning algorithms, such as neural networks, can potentially improve the accuracy of vehicle detection and tracking and enhance the system's ability to predict traffic patterns.

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