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IoT BASED SMART TRAFFIC SIGNAL MONITORING SYSTEM

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Abstract - Effective traffic management is one of the keys to smart city management Aspects. Traffic flow can be handled easily because it is possible to pre-estimate in advance the number of cars to travel through a busy intersection. The idea proposed presents a work capable of transmitting vehicle count periodically and generating an alarm when large vehicles arrive at the station controlling Bangalore or urban Indian cities. Using image processing techniques, the number of vehicles that travel through a place can be determined long before the appropriate traffic junction. In addition, the monitored detail can be sent to a remote area control center located anywhere in town through internet use.

Key Words: Internet of Things, Image processing, Blob detection, Raspberry Pi, Google Firebase.

1. INTRODUCTION

Indian city management idea is a collective info of various free active systems that play a significant role in traffic regulation. That can also be described as among the core facets of smart or developing city. The entire world is on the move extremely fast and with continuous progress, it will continue to fly in this direction. Modern transport, on the contrary, does not offer a smooth transport scheme for individuals. Excessive traffic delays causing the tired and irritated commuters to postpone their arrival at the office or home, wasting petrol, Wear and tear on or just a car frustration on the lane. In addition, increasing demographics specifically contribute to increased problems related to traffic, such as over-speed, injuries, hit and run, and so on. Crime acts such as cell snatching of traffic signals arise during lengthy traffic jams even in urban cities.

So smart traffic control emerged is a necessary aspect for stable society. Smart and capable TC system is currently preferred in most developing countries over fixed time schemes. This traffic management method is managed primarily with centrally controlled / server systems. In spite of this, the Internet of Things can be viewed as a resource for central server traffic control, which has proved its usefulness in almost everything of our everyday lives. The timely data collected for the city's traffic jam node can be distributed over the internet and cloud to handle car entry. We can use applications for image recognition in OpenCV to count the vehicles in real time.

Our plan is being cost-effectively applied and needs minimal maintenance. Thus, using concepts of IoT and Intelligent Image Processing, the proposed system manages traffic on local and centralized servers. Firstly, the camera collects data from the planned Indian areas setting system in real time.

Binary transformation and noise removal is performed on the collected data, after which it is split into frames. Then, blob detection is done and finally, count is measured using suggested car counting technique. Then, using internet based software, the collected vehicle count is displayed in the monitor at the station in real time. The traffic data in graphical form can be helpful to officials in real-time traffic control and management. Also, it can be useful for future planning purpose.

2. REVIEW OF LITERATURE

The project's main goal[1] is to make traffic management system function dynamically using the Internet of Things, Infrared Sensor, and Image Processing to make traffic systems work efficiently. In the market, traffic management automation systems aim to computerize the traffic lights, operate on a regular schedule to control the light (red / yellow / green) using various technologies such as GSM, NFC focuses on the basic operation of an electrical switch.

This project[1] aims to build an automated traffic management system which is capable of distributing data received from infrared sensors. Market-based traffic control automation solutions aim to computerize traffic signals and work based on routine schedules for changing light (red / yellow / green) using technologies such as Global Mobile Communication System (GSM), Near Field Communication (NFC), etc., concentrating on the simple function of an electrical switch. By use of such devices, there is substantial demerit in the signal waiting for a long time.

TSS system[3] is a wide area to explore where WSN is used to acquire traffic dense information on a particular road, incoming traffic flow, traffic load at peak hours and in vehicle priority. Wireless Sensor Networks that are deployed along a road can be used to control the traffic on roads and at junctions/intersection. At intersection points and in emergency vehicles respectively, sensors are deployed on either side of the roads.

Life in big cities involves moving quickly from one place to the next. Quicker travel needs quicker transport assistance, thereby the number of vehicles are increasing day by day and this creates constant pressure on the cities' traffic flow[4]. To keep pace with the development of these cities, traffic flow should be managed. We have already proposed and implemented a bidirectional traffic management support system based on Internet in real time. Decision-making in that program includes different details, including information relevant to roads and cars, including other environmental characteristics.

Traffic is among India's banes on urban life. Although only the poorest of the wealthy use public transport in developing countries, there is a social disparity in India when it comes to the use of public transport. This results in an exorbitant rise in the number of private vehicles and has contributed to a growing traffic snarls. One of the biggest problems caused by increasing vehicles the parking lot problems[5]. Vehicle management in parking areas has become an important aspect of making best out of existing space capacity. Owing to the rise in car count, loss of time and fuel at the parking area has become a major issue for big business such as Infosys, Accenture etc. that require multi-level parking facilities for their employees. For the optimal use of existing parking lot power, it is necessary to control the vehicle flow effectively.

The Internet of Things (IoT) appearance[6] provides a new trend to the development of intelligent traffic. This work proposes using the IoT, agent, and other technology to boost road flows and relieve road burden. Travelers and other users can be provided with information created by traffic IoT and gathered on all roads. The machine can identify current traffic activity, traffic flow conditions and also forecast the traffic flow in the future from collected real-time traffic data. It can also provide some of the latest traffic information in real time that will help drivers select optimal routes. The machine will then manage, track, and control moving vehicles accurately. Building an IoT-based smart traffic network has a range of benefits such as changing road flows, reducing traffic congestion and maintenance costs, good reliability, traffic protection and environmental independence

3. DESIGN OF PROPOSED APPROACH

The automated numbering of the vehicles going through a selected destination will be done using image processing techniques. Use a video-acquisition camera system footage of real-time traffic flow through road. A portable microprocessor data was analyzed using the encryption device after the video was acquired via camera

3.1 Methodology

After the camera system collected the video images, the encoding was performed on a microprocessor using Free CV tools. The movement of picture research undertaken to collect the amount of Vehicles which pass through a area of interest. The description of the measures adopted shall be provided as follows:

The first step is to extract the various frames from the video sequence

• To decrease the interference in the background image, it is passed through a Gaussian layered filter. In addition, a morphological operation is used to correct the objects in the image.

• The next step is to transform the image to a binary format in which the pixel representation is either converted to '1' or '0' based on the threshold or max value defined.

• The method of producing this threshold value was using the OTSU bimodal threshold.

• The binary threshold image is generated because the contours of objects in this type of image are easier to detect.

Transmission of information for traffic management system using internet

This communication process can be explained over the internet in four phases i.e. between system and the end-user server system.

Getting Vehicle Count Data from Open CV per second:

During the corresponding time interval, the average value of the vehicle present was recorded and stored within a vector that was changed for each set time period.

• Interfacing IoT Cloud with Microprocessor using Python: First, we have to have a server and a compact Microprocessor device must have internet connectivity to transfer processing information remotely to control center. We have used IoT cloud for the file. To use IoT cloud Server Time Database we must have compatibility with the Processor or Controller. To do so we will use Python language

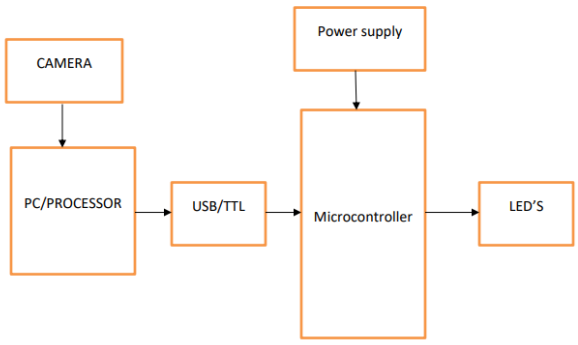
• Establishing IoT Link (Real Time Database): The next step after interfacing was to establish contact with our database. We 'd created new IoT cloud database for that. Then connect this to the database using Python's Credentials (Application Programing Interface) keys.

• Submit Vehicle Data to Real Time Cloud: Our job was to transfer data of vehicle counts to server remotely after connecting to the database. Once the data were sent using the above steps, the process repeats itself every second to provide the capture system's monitoring details continuously. The effects of the research completed, and the full production.

3.2 System block diagram

The machine block diagram as seen in Figure 1. The proposed structure is made up of three functional entities, the server, the MQTT IoT protocol, and the Traffic Management and Control Embedded Device that gathers traffic density.

Fig. 1: Block diagram.



Initially, the shot is captured by the traffic junction camera when it is free (Traffic density equal to zero). The camera shots the traffic junction constantly and captures the shot in real time.

The input for the vision system comprises image sequences captured from a camera. The pictures show the landscape those in front of the car, next to the road. The system's basic and primary role is to differentiate the vehicles from other moving and stationary objects in the pictures, and identify them as vehicles. This is very challenging as continuous monitoring along the road is done and the weather conditions vary along the time of day. It's difficult to recognize vehicles which suddenly enter the frame and with different dimensions and size.

First, we explain how we analyze and detect the motion information occupied by several adjacent picture frames of moving vehicles. Then we explain how an adaptive feature based approach can be used to identify vehicles in the field, which normally have minute relative changes between themselves and the camera-assisted car.

However, it is very difficult to recognize and analyze immediately from 1 or 2 images and will only work under certain and predictive conditions (e.g., sufficient contrast in between the vehicle and background). Thus, if the object or image are not recognizable spontaneously, the system will process several image frames and uses it to recognize vehicles.

4. System Requirement Specifications

4.1 Software Specification

- Python
- OpenCV library
- Firebase
- Arduino IDE

4.2 Hardware Specification

- Processor i3
- RAM 2 GB
- HDD 80GB
- Camera 720p
- NodeMCU

Fig. 2: Flow of process

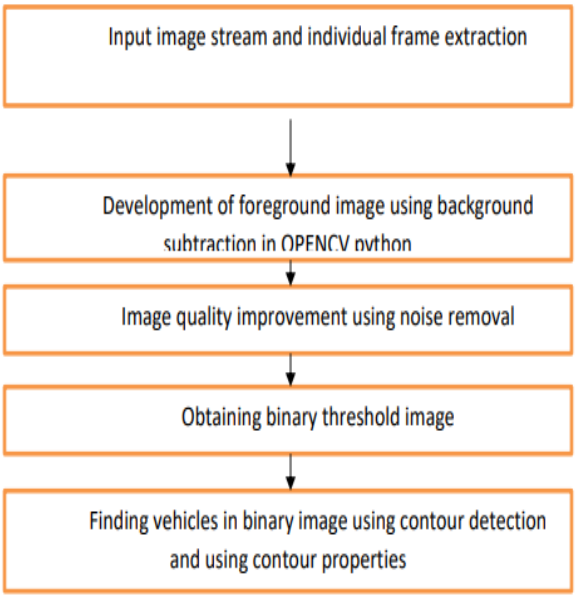
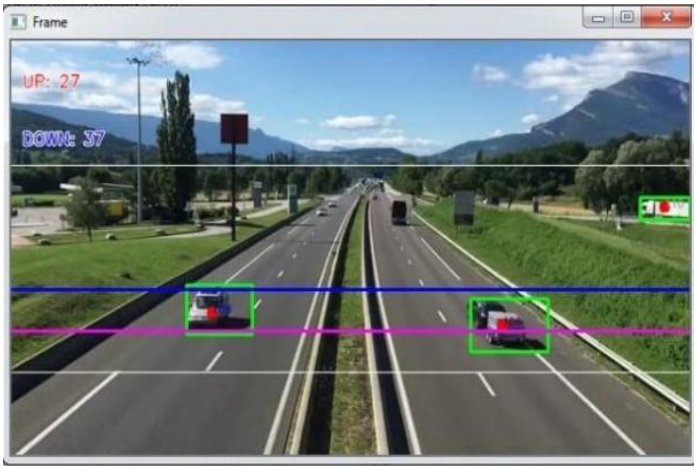


Fig.3: Result



5. RESULTS AND DISCUSSIONS

• A system to estimate the flow of traffic using Image Processing techniques is provided in this project. This is achieved by using the camera photos collected from the highway and the image sequences are translated to the videos taken. Processed image is stored separately, and it gives the count of vehicles in the frame.

• If the count exceeds the specified threshold, warning of heavy traffic are shown automatically. This new method is beneficial as there is use of image processing over sensors. The other advantages are its low cost, easy to setup and relatively good precision and speed.

• Using multiple IRs in the IOT model, the results of TMS are shown to monitor traffic flow, particularly route, for users and administrators. Customer users who check their traffic flow according to their wishes to know which lane and path usage is close to them in that area.

• We researched the method of image processing is best for monitoring the traffic lights. It demonstrates that with this it reduces the road traffic load and prevents the over-waiting period on heavy road and time spent on an empty road by a green signal. The detection of vehicles on the road is more standard as it uses actual traffic images. It shows better reality function than the existing system that is used for vehicle detection.

6. CONCLUSIONS

Combination of CV2 technology with the approach of IoT is intended to create an AI device that can easily manage traffic. As in the original version we used only desktop-based software as hardware. This would tend to be a cost-effective, lightweight tool that helps minimize traffic congestion at Glimpse Points intersections.

7. FUTURE SCOPE

Future software work could be to simplify the whole automotive inspection cycle, which would also include confidential real-time information on various types of cars. Thus car transfer can be achieved more robustly for traffic management.

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